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Virtual Coaching Of Novice Science Educators To Support Students With Emotional And Behavioral Disorders

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VIRTUAL COACHING OF NOVICE SCIENCE EDUCATORS TO SUPPORT STUDENTS WITH EMOTIONAL AND BEHAVIORAL DISORDERS

by

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ABSTRACT

Due to a multitude of convergent circumstances, students labeled in the disability category of emotional and behavioral disorders (EBD) experience high rates of academic and behavioral failure. Such failure frequently leads to the students' dropping out of school, involvement in the judicial system, or a combination of those outcomes. Science is an academic content area that has the potential to enhance behavioral and academic success of students with EBD. Researchers, nonprofits, and business leaders have provided an impetus for nationwide reform in science education. Concurrently, a corpus of legislation has influenced the preparation of new teachers to use evidence-based teaching practices while addressing the needs of an increasingly diverse student population. Using technology is one way that teacher educators are providing in-vivo learning experiences to new teachers during their classroom instruction.

A multiple-baseline across-participants research study was used to examine the effectiveness of providing immediate feedback (within three seconds) to novice general science educators to increase their use of an evidence-based teaching strategy, known as a three-term contingency (TTC) trial while they taught. Feedback was delivered via Bug-in-the-Ear (BIE) technology and during whole-class instruction in which students with EBD were included. The teacher participants wore a Bluetooth earpiece, which served as a vehicle for audio communication with the investigator. Teachers were observed via web camera over the Adobe®Connect™ online conferencing platform. During the intervention, teachers increased their percentage of completed TTC trials, opportunities to respond, and praise or error correction. Student responses also increased, and maladaptive behaviors decreased.

To Krista—

I love you—I mean it's oh so serious.

As serious can be.

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"She sings a song and I listen to what it says: If you want a friend, feed any animal...
There was so much space, I cut me a piece with some fine wine
It brought peace to my mind in the summertime... and it rolled!"

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

Introduction

Students with emotional and behavioral disorders (EBD) can benefit from the study of the natural world and the engaging contexts provided within general education science classrooms (Gillies, 2008; Scruggs & Mastropieri, 2007). Despite the potential for engagement of students with EBD in science content, this population of students is less likely to be included in the general education setting than any other disability category except students who are blind or deaf (Reid, Gonzalez, Nordness, Trout, & Epstein, 2004). A major impediment to the inclusion of students labeled EBD in general education settings is the lack of preparation of general educators to manage classroom behaviors of this population - particularly novice general educators (Scruggs & Mastropieri, 1995; Regan, 2009). The investigator in this study provided insight into supporting general education science teachers working with students who are EBD through an examination of the extent to which providing embedded professional development to novice science teachers increased their use of an evidence-based teaching strategy. Novice teachers in science were provided with synchronous professional development virtually via bug-in-the-ear (BIE) technology. The virtual professional development focused on an evidence-based teaching strategy called a three-term contingency (TTC) trial, more commonly referred to as a learn unit. The study took place during whole class instruction of students with EBD and their nondisabled peers in secondary science classrooms.

In this chapter, the investigator introduces and provides a summary of the overall components of the study and shares the legislation associated with the education of students with EBD. These legislative initiatives build the foundation for reform in science education within inclusionary settings for students with EBD. The contextualization of this reform combined with students with EBD being served in the general education setting is presented. Research is then given to the conditions under which schools operate in order to manage behaviors inclusively for all students, as well as the preparedness (or the lack thereof) of novice general education teachers to use effective behavioral management strategies among students with EBD in their classrooms. The chapter concludes with a description of the research questions, limitations of the study, and definitions of key terms.

Background

Legislative Foundation

Children and youth with EBD have historically lacked access to high quality content in the same settings as their nondisabled peers. With the passage of Public Law 94-142 (1975), commonly known as the Education of All Handicapped Children's Act (EHCA), students with disabilities have a legal basis for receiving a free and appropriate education in the least restrictive environment (LRE). The law required that students with disabilities receive instruction to the greatest extent possible alongside their nondisabled peers, resulting in a continuum of inclusive services (Kern, Hilt-Panahon, & Sokol, 2009). Subsequent revisions of the law have been improving accessibility to general education settings for students with disabilities, including EBD (Kauffman & Landrum, 2012).

Momentum toward the inclusion of students with disabilities in general education settings was further generated when former Assistant Education Secretary Madeline Will (1986) introduced the Regular Education Initiative (REI). In her seminal publication, Will (1986) called for an end to the dichotomous policies of educating children with disabilities separately from their nondisabled counterparts. The initiative called for the combining of regular and special education systems in a scenario where all teachers share responsibility for all students. As students with disabilities increasingly began to have access to general education settings, a need arose to establish protocols that set fair disciplinary actions for such learners.

A legal decision that addressed issues concerning the disciplining of students with disabilities who were included in general education settings was *Honig v. Doe* (1988). The case has had particular relevance for students with EBD, as this legislation protects against unfair disciplinary procedures for infractions that are manifested by students' disabilities. In *Honig v. Doe* (1988) the Supreme Court ruled that when a student who has a disability seriously misbehaves, the school is responsible to determine whether the misbehavior is a manifestation of her or his disability. A student cannot be expelled from school for misbehavior attributable to her or his disability. In addition, the decision stipulated that a temporary suspension in excess of ten days is a change of educational placement and triggers protection under the due process section of P.L. 94-142. The *Honig v. Doe* decision has served to accommodate the behavior of students with EBD when considering their educational placements in least restrictive settings.

Educational policies proposed by leaders in the field of special education continue to evolve and change the way in which students with EBD are educated. The Individuals with Disabilities Educational Act (IDEA, 1990) renamed PL 94-14 and created mandates for schools to provide transition services as students with disabilities ascended through school. The later

1997 revision of IDEA delineated the label of “emotional disturbance” as a means for receiving specialized educational services. The reauthorization of IDEA in 2004 further expanded services for students with EBD by calling for greater collaboration of general and special educators. Currently, the Elementary and Secondary Education Act is up for reauthorization, and this piece of legislation is expected to require even greater access and progress in the general education curriculum for all students with disabilities, including those with EBD. Collectively, these pieces of legislation provide greater opportunities for students with disabilities to gain access to and participate within the general education curriculum.

Shifting from access to the classroom to accessing the curriculum in the general education setting, the greatest political influence over the curriculum that exists today in the United States emerged from the Cold War (Business Roundtable, 2005). Reportedly in response to the launching of Sputnik I in 1957, the U. S. government directed unprecedented attention and funding to the development of programs in science and mathematics (NASA, 2007). In the years subsequent to the launch of Sputnik I, the federal emphasis on scientific progress diminished in comparison to other nations to the degree that in 2005, 15 of the most prominent business organizations in the United States formed a think-tank to express concerns about the country’s ability to maintain global competitiveness in the 21st century. In their report, *Tapping America’s Potential: The Education for Innovation Initiative,* the Business Roundtable (2005) set forth a core set of goals with the intention of doubling the number of science, technology, engineering, and mathematics (STEM) graduates with bachelor’s degrees by 2015.

The goals within the report addressed critical areas that were seen to affect the future choices students made and assigned actionable items to institutions of higher education. Action items include (a) promoting and strengthening resources to support best teaching practices, (b) strengthening teacher preparation programming for prospective math and science teachers, and (c) supporting cost-effective professional development to teach effectively (Business Roundtable, 2005). Subsequently, the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007 or America COMPETES Act (H.R. 2272, 2007) was signed into law in 2007 and was reauthorized in 2010. Educational provisions of the law include the development and implementation of two- to three-year, part-time masters programs in teaching for STEM education professionals to enhance their content knowledge and pedagogical skills in order to prepare them for teaching a diverse population of learners, including students with EBD. Placing an emphasis on reforming teacher preparation in STEM fields provides ideal opportunities for greater preparation, which should implicitly lead to more successful inclusion of students with EBD into general education science classrooms. Therefore, critical considerations must be given to the quality of interventions provided to early career science teachers in order to successfully include this population of students as required by evolving curricular & legislative reforms (Scruggs & Mastropieri, 2007).

Characteristics of Students Labeled EBD

Revised preparation programs should create teachers in science education with a greater understanding of the nature of students who are EBD. This population of students has unique circumstances and qualities that they bring daily into every educational and community settings (Kauffman & Landrum, 2012). In their seminal longitudinal study, Wagner, Cameto, and the National Center on Secondary Education and Transition (2004), identified critical characteristics and experiences of students with EBD that impacted their postsecondary outcomes. The results of the study reflected that students identified with EBD are predominantly African American males and typically come from families of low socioeconomic status. Students who are EBD most likely have a head of the household with no postsecondary education, and this person is often a single parent or extended family member.

These characteristics do not define a student with EBD, but they do provide some context to help teachers understand the challenges typically facing this population of students. The conditions students with EBD often experience typically manifests in socio-emotional and behavioral deficits that affect their educational access and outcomes (Kauffman, Brigham, & Mock, 2004; Vannest, Temple-Harvey, & Mason, 2009; Wagner et al., 2004). Behaviors exhibited by these students are typically categorized as either externalizing or internalizing (Hayling, Cook, Gresham, State, & Kern, 2008).

For students with EBD, time in school is also marked with poorer academic and behavioral outcomes than any other disability group (Reid et al., 2004). Consequently, the culminating educational event for a large percentage of students with EBD is dropping out of school (Bullock & Gable, 2006). Furthermore, outcomes for students with EBD upon leaving the educational setting are limited employability, involvement in the correctional system, and high rates of involvement in mental health services (Carter, Trainor, Sun, & Owens, 2009; Lane & Carter, 2006). Despite these facts, a body of research provides evidence that when students who are labeled EBD are included in general science classrooms they show improved academic success and engage successfully during inquiry-based group instruction (Gillies, 2008; Mastropieri et al., 2006; Scruggs & Mastropieri, 2007). Therefore, science teachers need to be adequately prepared in order to understand this population of students as well as to effectively implement school-wide, systemic recommendations in the areas of behavior that can improve the likelihood of success for students with EBD (Kauffman & Landrum, 2012). A readiness among novice science teachers to manage behaviors of some of the most challenging students would enable them to focus on providing high quality, engaging, hands-on content to all of their students while promoting access to content in which students labeled EBD tend to excel and thrive (Gillies, 2008; Rosenberg, Sindelar, & Hardman, 2004).

Systemic Factors

For many teachers of students labeled EBD, school-wide approaches to the management of behaviors can assist in curtailing many issues before they begin (Simonsen, Fairbanks, Briesch, Myers, & Sugai, 2008). Proactive, evidence-based efforts being implemented in school districts nationally under the auspices of the Positive Behavioral Interventions and Supports program (Sugai & Horner, 2006) could support students with EBD in general education settings:

> The Technical Assistance Center on Positive Behavioral Interventions and Supports has been established by the Office of Special Education Programs, U.S. Department of Education to give schools capacity-building information and technical assistance for identifying, adapting, and sustaining effective school-wide disciplinary practices (PBIS.org, 2012).

The school-wide positive behavioral interventions and supports (Sugai & Horner, 2006) were established to provide guidelines for a continuum of supports for teachers and their students. The recommendations were created to address the behaviors of all teachers and students in schools, and were intended to promote a more collaborative approach to sharing the responsibilities among special and general educators in promoting an inclusive school culture (Myers, Simonsen, & Sugai, 2011). The PBIS model has the potential to increase the likelihood of students with EBD being included in general education classrooms (Myers et al., 2011).

However, in order for any evidence-based approach for managing behaviors to be effective, teachers must be prepared to implement those practices with fidelity to have an impact on both student learning and academic outcomes (Rosenberg, Sindelar, & Hardman, 2004).

In addition to the PBIS recommendations to address behavior, science content leaders have recommended reforms that are increasingly mindful of including a broader student population in general education classrooms (McDuffie, Mastropieri, & Scruggs, 2009). Recent recommendations made by the National Science Teacher's Association (NSTA, 2011) toward science content reform call for increased use of inquiry-based instruction—an approach that has been proven to promote the success of students with EBD (Gillies, 2008; Scruggs & Mastropieri, 2007). Although students who have EBD are not specifically mentioned, these recommendations imply a readiness on the part of science educators nationally to accommodate learners with EBD in general education settings. Such a readiness could improve the likelihood of students with EBD being prepared to choose a career in a science-related field.

Preparedness of Novice Science Teachers to Educate Students With EBD

The majority of teachers of students with EBD lack the preparation to improve the students' academic or behavioral outcomes (Brownell, Ross, Colon, & McCallum, 2005; Rosenberg et al.,, 2004; Vannest et al., 2009). Educators with fewer than five years of teaching experience have historically expressed a lack of adequacy and preparation to manage classroom behaviors (Burden, 1982; Fuller, 1969; Fuller & Brown, 1975; Katz, 1972). However, when novice teachers are provided with adequate preparation in effective methods for managing classroom behaviors, they are more likely to have a sense of readiness to manage the behaviors of all of their students, including students with EBD (Jolivette, Stichter, & McKormick, 2002, Mastroprieri & Scruggs, 2001). The ability to manage classroom behaviors is particularly critical for new science teachers (Scruggs & Mastropieri, 1995).

With science teachers being expected to use engaging hands-on activities within the curriculum (NSTA, 2011), novice science educators have strong potential to include students with EBD if they are taught to use sound pedagogical strategies effectively (Mastropieri et al., 2006; Scheeler, 2008). However, early career teachers frequently do not implement evidence-based practices consistently and with fidelity (Abbott, Walton, Tapia, & Greenwood, 1999; Burns & Ysseldyke, 2009). In addition, their lack of experience with this population of students, novice science educators are often reluctant to include students with EBD in their classrooms (Larrivee & Cook, 1979; Mastropieri & Scruggs, 2001; Scruggs & Mastropieri, 1995).

Science educators who do teach students with EBD in their classrooms are less likely to use interventions that are appropriate to the students' needs (Kern et al., 2009). Baker and Zigmond (1995) found that when general educators included students with EBD in their classrooms, they expected the students to adapt to their style of instruction rather than modifying their teaching style to accommodate the students' needs. Simpson, Peterson, and Smith (2011) expressed concern that students with EBD do not receive an education by general education teachers who are prepared to use evidence-based strategies and pedagogies. Consequently, Rutherford and Nelson (1988) found that behavior changes in students are frequently not maintained because the teacher's behavior that produced the change itself was not maintained and resulted in the deterioration of desired student outcomes. Heward (1997) further stated that when teachers are taught a behavior without generalization, they often revert to using techniques that are disparate to those that they initially learned.

For example, the leadership of the Council for Exceptional Children (CEC, 1987) stated that eliciting frequent responses (4–6 per minute) of students with disabilities allows teachers to adjust the lesson based on feedback and increase the attentiveness of students. However, in their meta-analysis of studies concerning opportunities to respond (OTR), Sutherland and Wehby (2001) found, "that among students with EBD, teachers provided opportunities to respond at a range of 0.02 to 0.16 times per minute, well below the rate of 4–6 per minute recommended by effective instructional literature" (p. 117). Novice science education learning to effectively use strategies that elicit OTR among their students with EBD could also create avenues for providing feedback in the forms of error correction or praise (Albers & Greer, 1991).

When preparing early-career science teachers to use a new strategy, such as increasing their use of TTC trials during classroom-based research, an important consideration is to use the most efficient method of instruction in order to increase the likelihood that the teachers will use that strategy in the future (Haydon, Conroy et al., 2009). The implications of the research conducted on teacher development (Fuller, 1969; Fuller & Brown, 1975; Katz, 1972) indicates that when general educators have confidence in managing classroom behaviors, they can spend more of their time engaging their students in high quality content (Brownell et al., 2005).

Providing an embedded professional development during instruction could be a means by which new teachers can discreetly learn and master evidence-based strategies under the supervision of an expert while they are teaching (Rock, Gregg, Thead et al., 2009; Scheeler, McKinnon, & Stout, 2012). The process of seamlessly integrating research into practice in such a manner increases the likelihood of new science teachers generalizing best practices into their classroom routines (Rosenberg et al., 2004; Scheeler, 2008). Three term contingency (TTC) trials is an evidence-based practice that incorporates components that are commensurate with those established by the researchers from PBIS (Simonsen et al., 2008). Therefore, when teachers reach a level of mastery in using TTC trials, they can tailor the use of opportunities to respond (OTR; Sutherland & Wehby, 2001; Conroy, Haydon, et al., 2009) to the needs of all students in their classrooms, including those who are labeled EBD.

Statement of the Problem

Today's teachers face the challenges of providing instruction in an increasingly complicated curriculum to a widely diverse population of learners, including those identified with disabilities such as EBD (Darling-Hammond, 2010). Such demands cause nearly half of all teachers to leave the field of education within 5 to 7 years (Graham & Prigmore, 2009). Additionally, it takes 3 to 5 years for teachers to develop skills that enable them to consistently improve student achievement (Haycock & Hanushek, 2010). When considering that teacher quality is the single most accurate indicator of student success (Darling-Hammond, 2010), teacher preparation programs need to provide novice science educators with research-based pedagogies for ensuring a safe and positive learning environment for all students (Lane & Carter, 2006; Regan & Michaud, 2011; Simonsen et al., 2008; Simpson et al., 2011).

Novice science teachers often lack the pedagogical skills for managing the behaviors of a range of learners that are critical if they are to support the inclusion of students such as those with EBD in their classrooms (Mastropieri et al., 2006; Regan, 2009). A three-term contingency (TTC) trial is an evidence-based teaching strategy whose foundation is in applied behavioral analysis (Skinner, 1968). A complete TTC trial incorporates (A) teacher presentation of opportunities to respond (OTR), (B) student response, and (C) teacher consequence in the form of error correction or praise (Albers & Greer, 1991; Scheeler & Lee, 2002). Research has shown that science is the content area that has the most potential for the accessibility and engagement of students with disabilities (Appleton & Lawrenz, 2011). Therefore, when science educators use evidence-based strategies such as TTC trials effectively, they may be more likely to remain in the field of education (McKinney, Haberman, Stafford-Johnson, & Robinson, 2008). Further, this type of practice, using TTC trials, has been shown to have an impact on the academic and behavioral success of students with EBD (Haydon, Conroy, et al., 2009).

During times when novice teachers are typically provided support during their beginning of their teaching career, the presence of a university or school district supervisor has been reported to be distracting and even intimidating (Rock, Gregg, Thead et al., 2009). An innovative way to alleviate the potential for such conditions can be accomplished by the use of conducting supervisions covertly and virtually via bug-in-the-ear (BIE) technology (Scheeler & Lee, 2002). Supervising using BIE involves technology that includes a Bluetooth® earpiece, a webcam-enabled device that has an Internet connection with Bluetooth capability, and a web-conferencing platform such as Adobe® Connect™. Researchers have used BIE to effectively deliver immediate covert feedback to novice teachers on their use of evidence-based practices in multiple settings (Goodman & Duffy, 2007; Goodman, Brady, Duffy, Scott, & Pollard, 2008; Scheeler, McAfee, Ruhl, & Lee, 2006; Scheeler et al., 2012). Teachers have reported that while receiving feedback via BIE, that the technology is a valuable way in which to be supervised unobtrusively without the distraction of another adult in their classroom (Scheeler et al., 2012).

The preparation of science teachers who will work with students with EBD needs to include instruction in evidence-based strategies to learn how they can use these techniques consistently and effectively (Mastropieri & Scruggs, 2001; Simpson et al., 2011). Assisting novice science teachers to master the effective delivery of TTC trials could provide the professional development called for by NSTA while satisfying the criteria of evidence-based practices within PBIS (NSTA, 2011, Simonsen et al., 2008). Further, the use of innovative technology to teach the use of TTC trials could covertly provide novice science teachers the skills they need to work with students who have EBD in their classroom without the direct physical presence of their mentors or university supervisors (Scheeler, 2008). This study demonstrates how novice science teachers both acquired and mastered the use of TTC trials in inclusive science classrooms for their students with EBD using BIE supervision.

Rationale

The legislative advocates on behalf of students with disabilities have paved the way for greater inclusion of students with EBD in general education settings (e.g., IDEA, 1997; NCLB, 2001). In order for the inclusion of this population of students to be meaningful, their teachers must be adequately prepared to promote their academic and behavioral success (Haydon, Conroy et al., 2009). The use of TTC trials is an evidence-based teaching strategy that used effectively has been shown to increase the engagement of students with EBD in an elementary science setting (Haydon, Mancil, & Van Loan, 2009). Although the studies concerning the coaching of TTC trials reviewed for this research all targeted teachers of students with disabilities, the strategy is grounded in applied behavioral analysis, and is appropriate for use with all students (Albers & Greer, 1991; Goodman & Duffy, 2007). The teachers in the current study taught in general education science classrooms where general education students learned alongside their peers with EBD.

Modern technologies such as BIE have been used to deliver embedded virtual professional development to novice teachers during a variety of content instruction, including reading, language, and mathematics (Rock, Gregg, Howard et al., 2009; Wade, 2010). Bug-in-the-Ear technology has been used to deliver immediate feedback on the completion of TTC trials among novice teachers during instruction in content areas (Goodman et al., 2008; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler et al., 2012). However, the use of BIE has not yet been used to deliver immediate feedback to novice general educators of students with EBD during science instruction.

The applicability of science instruction for students who are EBD and the need for novice teachers to receive support in managing classroom behaviors to the degree that they can work confidently with this population is important as the United States is experiencing a critical shortage of adequately prepared science educators (ACA, 2010; USDOE, 2010). Since the general education science classroom is one of the more engaging content areas, given the right supports students with EBD can succeed which has direct implications for improving postsecondary outcomes, including access to advanced college and career pathways (McCarthy, 2005; McDuffie et al., 2009). Therefore, the rationale for the proposed study is to extend existing research involving the delivery of immediate feedback to novice science teachers via BIE in order to master the completion of TTC trials among students with EBD in their inclusive classrooms. **Error! Reference source not found.** provides the logic model used to support the overall framework for this research study.

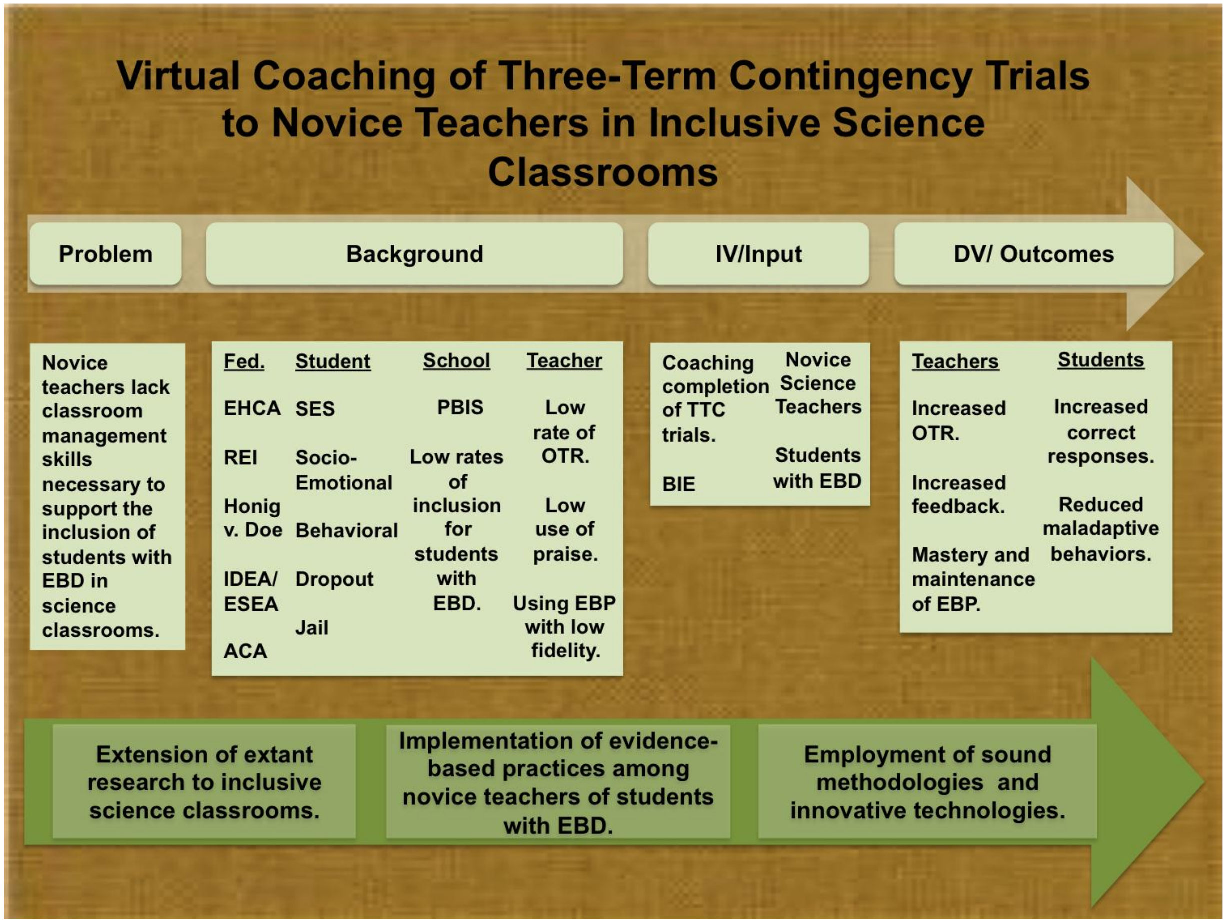


Figure 1: Study Logic Model

Conceptual Framework

The conceptual framework for this study is built upon the existing literature of evidence-based practices in classroom management. Simonsen her and colleagues (2008) in their review of the literature identified five evidence-based, critical features of effective classroom management: (a) maximize structure; (b) post, teach, review, monitor, and reinforce expectations; (c) actively engage students in observable ways; (d) use a continuum of strategies for responding to appropriate behaviors; and (e) use a continuum of strategies for responding to inappropriate behaviors. Albers and Greer (1991) specifically provided the field with the three components of TTC trials. Their work supports the use of (A) teacher presentation of OTR; (B) student response, and (C) teacher consequence in the forms error correction or praise (Albers & Greer; 1991; Scheeler & Lee, 2002) and these three steps can be used to satisfy the evidence-based features identified by Simonsen and her colleagues (2008). Despite novice teachers having the benefit of learning proven, evidence-based teaching practices, such as TTC trials, during their preparation at universities (Gersten, Vaughn, Deshler, & Schiller, 1997), typically they do not learn to generalize these newly learned teaching behaviors (Scheeler, Bruno, Grub, & Seavey, 2009).

Innovative technologies such as BIE have been used to covertly develop the skills of novice general and special educators alike (Rock, Gregg, Gable, and Zigmond, 2009; Rock, Gregg, Howard et al., 2009; Rock, Gregg, Thead et al., 2009). Further, the use of BIE technology by researchers has aided novice teachers in generalizing their use of TTC trials in the areas of reading, writing, and mathematics (Scheeler, Congdon, & Stansbury, 2010; Scheeler et al., 2012). To date, no studies have examined the use of BIE to help novice general educators in the science content to master and generalize the evidence-based teaching cycle addressed within TTC trials, particularly when there are students labeled EBD included in their classrooms.

In addition to meeting the demands of curriculum reform described by the National Research Council (NRC, 2012), novice science teachers face many challenges to provide engaging contexts in which a diverse student population can learn (Appleton & Lawrenz, 2011; Darling-Hammond, 2010). Under such circumstances, novice teachers often allow their newly learned skills to deteriorate once they enter their own classrooms (Billingsley, Griffin, Smith, Kamman, & Israel, 2009). Providing embedded virtual professional development to novice science teachers via BIE to use TTC trials can provide the necessary support to optimize the likelihood of the teachers' increasing their use of this evidence-based teaching strategy with their general education students as well as their most challenging students in a discreet manner (Rock, Gregg, Howard et al., 2009; Scheeler & Lee, 2002). **Error! Reference source not found.** rovides examples and non-examples of complete TTC trials within an inclusive science classroom:

<table>
<tr><td colspan="3">Example</td><td colspan="3">Non-Example</td></tr>
<tr><td colspan="3">(Correct Student Response)</td><td colspan="3">(Correct Student Response)</td></tr>
<tr><td><u>Teacher (A)</u>
“What is the process by which weather is created?”</td><td><u>Student (B)</u>
“ The water cycle”</td><td><u>Teacher (C)</u>
“Great work, Amber! The water cycle creates the weather we experience”</td><td><u>Teacher (A)</u>
“What is the series of underwater volcanoes in the Pacific called?”</td><td><u>Student (B)</u>
“The Ring of Fire.”</td><td><u>Teacher (C)</u>
Teacher: Says nothing in response to student’s answer and continues on to the next question, therefore, not completing the TTC trial.</td></tr>
<tr><td colspan="3">(End of TTC Trial)</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">(Incorrect student response- Consists of 2 trials)</td><td colspan="3">Incorrect student response</td></tr>
<tr><td><u>Teacher (A)</u>
“What is the process by which weather is created?”</td><td><u>Student (B)</u>
“The weather cycle”</td><td><u>Teacher (C)</u>
“Close, but not correct. The water cycle creates weather.”</td><td rowspan="5"><u>Teacher (A)</u>
“What is the series of underwater volcanoes in the Pacific called?”</td><td rowspan="5"><u>Student (B)</u>
“Funky Town.”</td><td rowspan="5"><u>Teacher (C)</u>
“Who knows the answer?” (Non-example of a TTC trial because the teacher responds by asking another student to answer the question instead of correcting the error with the student who made it.</td></tr>
<tr><td colspan="3">(End of first TTC Trial)</td></tr>
<tr><td colspan="3">(Begin second TTC Trial)</td></tr>
<tr><td><u>Teacher (A)</u>
“What is the process by which weather is created?”</td><td><u>Student (B)</u>
“The water cycle.”</td><td><u>Teacher (C)</u>
“That’s what I’m talking about! It’s the water cycle that creates weather.”</td></tr>
<tr><td colspan="3">If the teacher presents an antecedent (A) to the student (i.e., opportunity to respond) and either the student responds correctly (B) but the teacher does not provide praise or the student responds incorrectly (B) and the teacher fails to correct the answer with the student who makes the error, it will not be counted as a completed TTC trial (Scheeler et al., 2012, p. 81)</td></tr>
</table>

Adapted from Scheeler et al., 2012.

Figure 2: Examples and Non-Examples of TTC Trials

The provision of OTR and praise are known to be effective means of promoting positive classroom environments (Conroy, Haydon et al., 2009; Sutherland & Wehby, 2001). Further, the incorporation of feedback as the third component of a TTC trial provides meaningful information to students with EBD, who value the relationship with their teachers and benefit when their individual strengths and attributes are acknowledged (Parsons, Godfrey, & Howlett, 2001). The intervention also has a high likelihood of generalizing the teaching behavior post treatment (Scheeler, 2008). Moreover, the acquisition, mastery, and maintenance of the use of TTC trials can enhance the likelihood of postsecondary opportunities for students with EBD (Scheeler et al., 2012; Wagner et al., 2004; see **Error! Reference source not found.**).

Research Questions

The investigator examined the effectiveness of providing immediate feedback via BIE to novice science teachers to increase their completion of TTC trials among students identified as having EBD in their classrooms. Specifically, the investigator sought to answer the following questions:

(1) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the percentage of completed TTC trials;

(2) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the rate of correct student answers; and

(3) Will the teachers maintain their newly learned behaviors when the intervention is removed?

Independent Variable

The independent variable for this study was the delivery of embedded virtual coaching via BIE by the investigator to the participants in the form of immediate feedback on their completion of TTC trials.

Dependent Variable

The treatment package described above was used to evaluate changes in frequency of the three components of TTC trials. Specifically, the dependent variable is composed of (a) teacher presentation to the student of an opportunity to respond, (b) student response to the teacher prompt, and (c) teacher feedback in the form of praise or correction. Data were collected on each component across conditions. A completed TTC trial was counted only if it had each of the three components satisfied (see Appendix A). Feedback from the investigator was provided to the teacher participants during treatment to reinforce the completion of trials (See Appendix I).

Procedures

Research Design

This single-subject multiple-baseline study comprised the following conditions: (A) baseline, (B) treatment, and (C) maintenance. The investigator solicited participants having the following delimiting factors: (a) each of the participants were novice science teachers (defined by fewer than five years of teaching), (b) each participant taught in a secondary general education science classroom setting, (c) each participant had at least one student with EBD included in the general science class, and (d) each participant agreed to receive embedded virtual professional development on an evidence-based teaching strategy via BIE. Once selected, the participants completed an inventory to determine demographic information and specifics about their level of preparation to manage behaviors, their classroom ecologies, and student characteristics. Arrangements were made with the technology administrative personnel at the participants' schools to facilitate the use of the BIE components and Adobe® Connect™ web conferencing platform. Participants then received training to prepare them to use the technology that was used during the study.

Baseline data collection (see Appendix I) commenced once the participants had the skills necessary to use the BIE earpiece and Adobe® Connect™ and the technology had been tested in the teachers' classrooms. The treatment was then staggered across participants beginning with the participant who had the lowest and most stable baseline data collected after five 15-minute sessions (Cooper, Heron, & Heward, 2007; Gast, 2010; Horner et al., 2005; Kazdin, 2011). All participants had equivalent baseline conditions, so a name was randomly drawn from a hat to determine the first participant (Gast, 2010). Once the first participant reached a criterion of 90% of 3–5 completed TTC trials per minute, the treatment was faded for that participant, and another name was randomly drawn to determine the next participant to receive treatment (Horner et al., 2005).

Treatment Conditions

Novice science teachers (N=3) participated in this study based upon the aforementioned criteria. During the treatment condition, the teachers received immediate feedback (within 3 seconds; Scheeler & Lee, 2002) virtually via BIE over the Adobe® Connect™ platform on their completion of all three components of TTC trials. Appendix A provides examples and non-examples of TTC trials, while Appendix I provides protocols for providing immediate feedback to the teachers on their completion of TTC trials. The study took place during the third and fourth quarters of the academic year in their public school classrooms. Upon completion of the maintenance condition, participants answered a written survey to determine the social importance of the study (Wolf, 1978).

Data Analysis

Single-subject designs provide "experimental documentation of unequivocal relationships between manipulation of independent variables and change in dependent variables" (Horner et al., 2005, p. 169). The results of this single-subject study were analyzed through systematic visual comparison of response to the intervention across conditions of the study (Parsonson & Baer, 1978). Visual analyses were conducted to determine the change in trend direction and level regarding the percentage of completed TTC trials (see Appendix A) on the part of teachers and their students (Kazdin, 2011). Additional analyses were conducted to determine whether the intervention affected the number of correct student responses. Tau-U analysis of non-overlap and trend of data was used to demonstrate effects of the treatment on the dependent variables (Parker, Vannest, Davis, & Sauber, 2011). Content analysis was conducted on the social validity survey (Cresswell, 2007).

Reliability

Analysis of the change in trend direction of the percentage of completed TTC trials serves to determine the reliability of effect that the change in condition conditions had on the dependent variable (Cooper et al., 2007; Gast, 2010; Horner et al., 2005). To provide evidence that the measures of the dependent variable were accurate, a second observer independently scored data on a minimum of 30% of all sessions across each condition of the study at a level of at least 90% agreement (Kazdin, 2011).

Validity

Validity of results of studies using single-subject designs is presented through the replication of the effects of the intervention across the participants and conditions within the study (Horner et al., 2005). Prominent experts who have previously used the protocols and instruments in their studies have provided them to the investigator. Minor revisions to the protocols and instruments have been reviewed and approved by the experts for appropriateness of use for this study. Student academic behavioral changes were documented within the design in terms of student engagement as measured by rate of correct response. Participant value of the study has been ascertained by a social validity survey that was conducted at the conclusion of the study (Wolf, 1978).

Fidelity of Treatment

A second trained observer conducted checks on the investigator's fidelity of coaching for at least 30% of each participant's sessions during each condition of the study using the Fidelity of Treatment Checklist (see Appendix B). The observer was trained on the modeling of examples and non-examples of TTC trials using recorded performances (see Appendix A and Appendix D) of persons not involved in the study modeling complete and incomplete TTC trails using the protocols within Appendix A until at least 90% accuracy was reached.

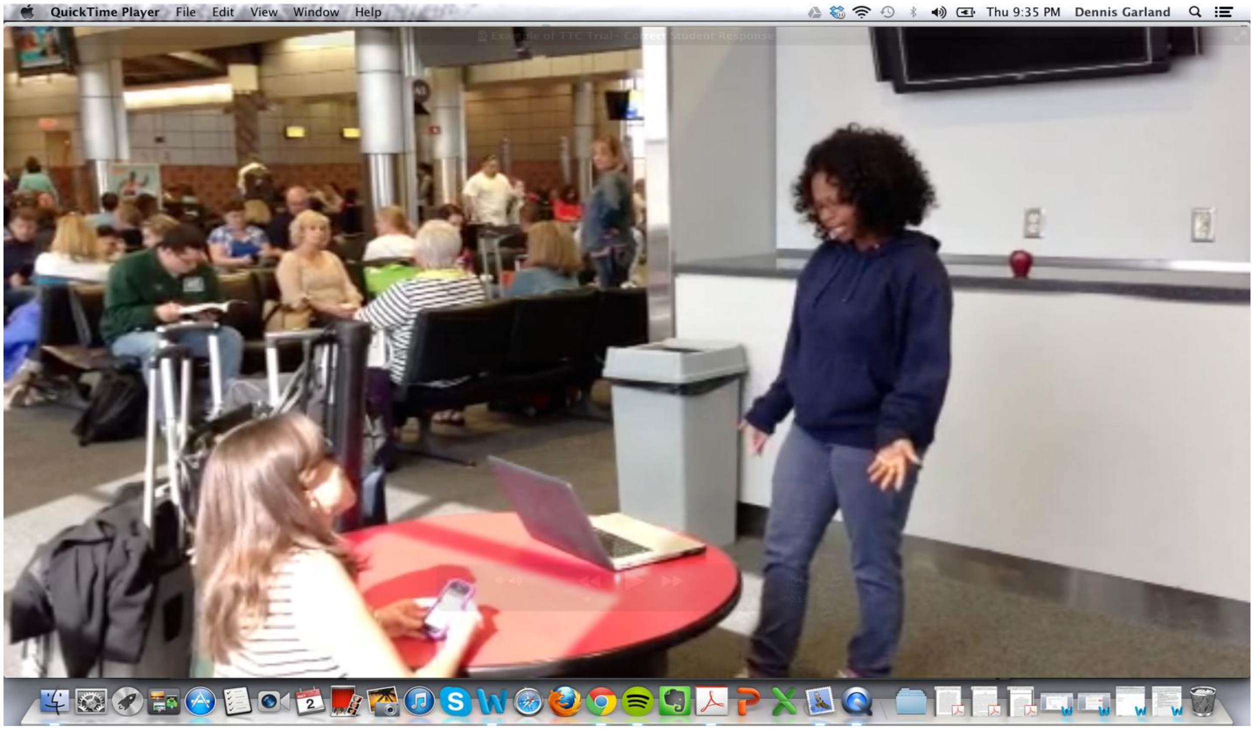


Figure 3: Screen Capture of Recorded Performance of the Modeling of Complete and Incomplete TTC Trials

Definitions of Key Terms

The key terms identified below are defined for the purpose of clarity as they pertain to the proposed research study.

Adapter: A technology device that allows short-range wireless transmission between the classroom computer and the earpiece. The adapter permits pairing of the earpiece with the teachers' classroom computers (Rock, Gregg, Howard et al., 2009).

Adobe® Connect™: A web-based conferencing platform that allows for synchronous audio and video communication (audio, video, text, and graphics), and document sharing within a virtual classroom that is accessed from a fixed web address (Vasquez, 2009). Adobe® Connect™ was used in this study as the virtual setting for BIE communication.

Bug-in-the-Ear (BIE) technology: A wireless communication system used to provide covert feedback over the Internet to teachers while they are working with their students (Rock, Gregg, Howard et al., 2009; Scheeler & Lee, 2002).

Covert Coaching: Providing teachers with immediate feedback that is encouraging, instructive, and corrective through electronic means via the Internet and BIE (Rock, Gregg, Gable et al., 2009). The terms virtual coaching and covert coaching will be used interchangeably throughout the study but have the same meaning.

Delayed Feedback: Feedback from the investigator that is given to teachers 5–30 minutes after an observation session (Scheeler & Lee, 2002).

Embedded Professional Development: Professional development that takes place while a teacher is instructing students.

Emotional and Behavioral Disorders (EBD): The IDEA (1997) legislation delineated the definition of *emotional disturbance* as:

> The term means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance: (a) an inability to learn that cannot be explained by intellectual, sensory, or health factors; (b) an inability to build or maintain satisfactory interpersonal relationships with peers and teachers; (c) inappropriate types of behavior or feelings under normal circumstances; (d) a general pervasive mood of unhappiness or depression; (e) a tendency to develop physical symptoms or fears associated with personal or school problems. The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance. (CFR §300.7 (a) (9))

The term *emotional and behavioral disorders* was adopted by the National Special Education and Mental Health Coalition in 1987 to acknowledge that the students to whom the label refers may express disorders of emotion or behavior, or both (Forness, 1988; Forness & Knitzer, 1992; Kauffman & Landrum, 2012). Although the federal term remains emotional disturbance, for the purposes of this paper, EBD will be used hereafter.

Headset: An earpiece and microphone that provide a two-way audio connection to a computer via technology so that the co-teacher and coach can communicate discreetly (Rock, Gregg, Howard et al., 2009).

Immediate Feedback: Feedback that is given by the investigator to teachers within 3 seconds in the form of correction or praise (Scheeler & Lee, 2002).

Inclusive Classroom: A classroom in which an educator teaches students with special needs in the general education setting (Murawski & Dieker, 2008).

Novice Science Teacher: A teacher of science content who has fewer than 3 years of teaching experience (Scheeler & Lee, 2002).

Positive Behavioral Support Strategies (PBIS): A school-wide framework for addressing the needs of students with problematic behaviors to reduce the likelihood of behavioral infractions (Simonsen et al., 2008).

Science, Technology, Engineering, and Mathematics (STEM): Curricular content in the fields of science, technology, engineering, or mathematics (Business Roundtable, 2005).

Technology: A wireless protocol that connects multiple electronic devices within short-ranges (Wade, 2010).

Three-Term Contingency Trial (TTC): An evidence-based teaching strategy that comprises (A) a teacher-prompted opportunity to respond (OTR) to the student, (B) the response of the student, and (C) teacher feedback in the form of praise or error correction (Scheeler & Lee, 2002).

Virtual: Having the essence or effect but not the appearance or form of: e.g., a virtual revolution.

Virtual Coaching: Providing teachers with immediate feedback that is encouraging, instructive, and corrective through electronic means via the Internet and BIE (Rock, Gregg, Howard et al., 2009). The terms virtual coaching and covert coaching are used interchangeably throughout the study but have the same meaning.

Voice Over Internet Protocol (VOIP): An Internet Protocol (IP) telephony system used to manage the delivery of voice information over the Internet. Voice information is sent in digital form in discrete packets rather than the circuit-committed protocols of public switched telephone networks.

Limitations

This study used a single-subject design to investigate the research questions. Therefore, generalizability of the results is limited to the participating novice science teachers only (Cooper et al., 2007; Gast, 2010; Horner et al., 2005; Kazdin, 2011). Another limitation is that the mere virtual presence of the investigator may have influenced the behavior of the participants rather than the intervention of immediate feedback, thereby limiting the results. The willingness of the teacher participants to complete the social validity survey honestly and thoroughly at the conclusion of the study may have limited the results of the survey in terms of social value (Wolf, 1978). Finally, the precipitating factors for the behavioral manifestations of students with EBD are largely ecological (Kauffman & Landrum, 2012; Wagner et al., 2004). Therefore, antecedents outside of the science classrooms in which the study occurred could have presented limiting circumstances to the study.

CHAPTER TWO: REVIEW OF LITERATURE

Chapter Overview

Due to their complex nature, students diagnosed with EBD have historically presented unique challenges to educators (Oliver & Reschly, 2010; Reid, Gonzalez, Nordness, Trout, & Epstein, 2004; Vannest et al., 2009). Without adequate preparation and expertise in classroom management, teachers of students with EBD can exacerbate the academic and behavioral deficits of their students (Espin & Yell, 1994; Kauffman & Landrum, 2012; Oliver & Reschly, 2010; Regan, 2009). The literature reviewed for this study provides the researchers' perspectives on the characteristics of students with EBD and evidence-based practices for managing the behaviors of this population. Highlighted among these practices is a description of TTC trials. Subsequently, a discussion of the importance of including students with EBD in the general education setting, specifically within science, to ensure access to high quality content material is provided. The issue of access to inclusive settings is combined with the necessity to prepare teachers to meet the needs of students with EBD who may be present in the general education setting. The chapter concludes with a discussion of using innovative technologies with novice teachers (e.g., BIE technology) to increase the success of students with EBD in the general education science setting.

Legislative Perspective on the Treatment of Children With Mental Disorders

Prior to the identification of EBD, children and youth with mental disorders had been identified as delinquent or mentally defective (Wallin, 1922). The determination of delinquency was judicial in nature and was affected by early compulsory education laws such as the Massachusetts Education Laws of 1642, 1647, and 1648, which were intended to educate students "to read and understand the principles of religion and the capital laws of this country" (Hunt, 1999, p. 142). Eberling (1999) explained that the law of 1642 stated that education was to be administered by parents and was punishable by a fine. Implementation was suspected to be negligent, and the 1647 law impelled the towns of the colony to create, operate, and fund schools (Hunt, 1999). According to early compulsory attendance laws, children who refused to attend school were sent to reform schools such as Westboro in Massachusetts, which combined education with the juvenile justice system (Richardson, 1994).

States later changed the laws in ways that they considered to be in the interest of child welfare and social betterment (Richardson, 1994). Legislative mandates included the imposition of fines for failure to report children who were blind and/or deaf to state institutions (essentially a child-find provision), extending compulsory attendance laws to include children considered at that time to be feeble-minded, deaf, blind, crippled, or delinquent. At the same time, special public school classes or specialized instruction were established for the aforementioned children, psycho-educational and physiological evaluations for referral of students, classification and segregation of students that "should be segregated," and the prohibition of the marriage of the "imbecile, feeble-minded, insane, and epileptic" (Wallin, 1922, p. 77). Richardson (1994) summarized the relationship between compulsory attendance laws and institutions:

> While the worlds of the common, delinquent, and special originated as separate institutional structures, the rule of compulsory attendance redefined expectations for ensuring the education of children. Universal compulsory education was possible because the caveats to this responsibility were already in place: Those conditions of

unsound mind and ill health were exempted, and those of delinquent conduct could be expelled. (p. 722)

The compulsory attendance laws created a conundrum for dealing with those students who were considered to be delinquent and for years provided avenues for excluding students from general educational settings (Osgood, 2008).

Until 1950, children with psychological disorders were typically institutionalized in hospitals for the mentally ill (Osgood, 2008). Children considered to be psychologically unsound were often relegated to insane asylums or treated with dubious medical procedures (Blatt, Kaplan, & Sarson, 1966). At that time, laws did not yet exist in the United States that required school districts to educate all students (Wood, 2001). The dearth of legislative protection for persons presumed to be mentally unsound resulted in conditions that were fraught with unfavorable circumstances, such as

- the use of trepanning, a process by which a hole was drilled into the skull of persons with mental disorders to alleviate pressure (Brothwell, 1963);
- the Salem Witch Trials of 1692 (Spanos & Gottlieb, 1976);
- the establishment of the Massachusetts School for Idiotic and Feeble-Minded Youth, South Boston in 1848;
- confinement to institutions such as The Boston Hospital for the Insane, built in 1860;
- passage of Law for the Prevention of Hereditarily Diseased Offspring (1933) in Nazi Germany; and
- institutionalization at Willowbrook State Hospital in New York, which Senator Robert F. Kennedy condemned as a "snake pit," forcing children to live "amidst brutality and human excrement and intestinal disease" (Blatt et al., 1966, p. 89).

In the early half of the 20th century, interventions for students with EBD were typically based on mental health practices and psychoanalytic theory and were presented as case studies (Kauffman et al., 2004). Not until the 1950s were experimental research studies introduced to the field related to educating students with EBD, resulting in a limited literature base of research-based practices for this population (Council for Exceptional Children, 1964).

Legislation Affecting Children With Behavioral and Mental Disorders

For students with behavioral and mental disorders, legislative actions have ameliorated educational and social opportunities, such as:

- the Education of All Handicapped Children Act (PL 94-142) became federal law in 1975. This law requires school officials to provide a free, appropriate public education, suited to the student's individual needs, and offered in the least restrictive setting for all students with disabilities. States were given until 1978 (later extended to 1981) to fully implement the law;
- the Civil Rights of Institutionalized Persons Act (CRIPA, 1980) authorized the Attorney General to conduct investigations and litigation relating to conditions of confinement in state or locally operated institutions (the statute does not cover private facilities);
- the *Honig v. Doe* decision January 20, 1988, in which the U.S. Supreme Court held that a student with emotional disorders could be suspended for a period of up to ten days. More than ten days triggers the Due Process Clause of the 14th Amendment;
- the Americans with Disabilities Act of 1990 (ADA), which is a wide-ranging civil rights law that prohibits, under certain circumstances, discrimination based on disability;
- the Individuals with Disabilities Education Act (IDEA; 1990). Public Law 101-476, renamed and amended Public Law 94-142, which, in addition to changing terminology

from handicap to disability, still today mandates transition services and added autism and traumatic brain injury to the eligibility list; and

- the 1997 revision of IDEA, which identified students with EBD in order for them to receive funding for special education services.

The legislative changes that took place on behalf of persons having disabilities provided an impetus for the greater inclusion of students with EBD into general education classrooms. Momentum toward the inclusion of students with disabilities in general education settings was further generated when former Assistant Education Secretary Madeline Will (1986) introduced the Regular Education Initiative (REI). In her seminal publication, "Educating Children With Learning Problems: A Shared Responsibility," Will (1986) called for an end to the dichotomous policies of educating students with disabilities separately from their nondisabled counterparts. The initiative called for the combining of regular and special education systems in a scenario wherein all teachers share responsibility for all students. Will's (1986) assertion took the step beyond accessing schools to accessing classrooms.

Contemporary Status of Children and Youth With the EBD Label

With the passage of IDEA (1975) came the creation of labels used to discuss, treat, and educate the various populations of students with disabilities. Since the passage of the original law many labels have been used to describe students who receive services under IDEA (1997) for emotional disturbance. Kauffman and Landrum (2012) discussed the combinations of terms used to describe students with EBD, shown in Table 1. The terms in column A are frequently used in combination with another term in column B. For example, emotionally disturbed, emotionally maladjusted, socially handicapped, and so forth have been used over time.

Table 1

Combination of Terms Used for Labeling Students

A	B
Emotionally	Disturbed
Behaviorally	Disordered
Socially	Maladjusted
Personally	Handicapped
	Conflicted
	Impaired

Kauffman and Landrum (2012) noted that none of the combinations of terms used to describe the disorders have ever expressed a positive connotation. The IDEA (1997) legislation delineated the definition of *emotional disturbance* as

> The term means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance: (a) an inability to learn that cannot be explained by intellectual, sensory, or health factors; (b) an inability to build or maintain satisfactory interpersonal relationships with peers and teachers; (c) inappropriate types of behavior or feelings under normal circumstances; (d) a general pervasive mood of unhappiness or depression; (e) a tendency to develop physical symptoms or fears associated with personal or school problems. The term includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance. (CFR §300.7 (a) (9))

The term *emotional and behavioral disorders* was adopted by the National Special Education and Mental Health Coalition in 1987 to acknowledge that the students to whom the label refers may express disorders of emotion or behavior, or both (Forness, 1988; Forness & Knitzer, 1992; Kauffman & Landrum, 2012). Although the federal term remains emotional disturbance, for the purposes of this paper, EBD will be used.

Students who meet the criteria defined in IDEA (1997), as determined by a multidisciplinary team, may receive special education services under the EBD label. Students under the age of nine who exhibit delays in social or emotional development may receive services under the developmental delay category. Other federal agencies such as the Center for Mental Health Services (CMHS, 1993) and the Substance Abuse and Mental Health Services Administration (SAMHSA, 1993) use different eligibility criteria for youth with EBD. Their definitions cover a broad array of mental health conditions, some of which may also lead to eligibility under IDEA.

For example, the CMHS (1993) definition covers children under 18. This definition requires the presence of a diagnosable mental, behavioral, or emotional disorder of sufficient duration to meet diagnostic criteria specified within the *Diagnostic and Statistical Manual of Mental Disorders, 4th ed*. (APA, 2000), and which results in a functional impairment that substantially interferes with or limits the child's role or functioning in family, school, or community activities (SAMHSA, 1993). In addition, the Social Security Administration's (SSA) definition of eligibility for the children's Supplemental Security Income program is "the presence of a mental condition that can be medically proven and that results in marked and severe functional limitations of substantial duration" (American Institutes for Research [AIR], 2001, p. 2).

Students identified under these two definitions may be eligible for services under IDEA (1997) or under Section 504 of the Rehabilitation Act of 1973. However, eligibility is not automatic. A child must meet the requirements of the Department of Education's regulatory definition of emotional disturbance to receive services under IDEA (or must meet the requirements of other IDEA eligibility categories). Therefore, identification of a child as EBD under the CMHS or SSA definitions does not necessarily lead to identification under IDEA for special education services (AIR, 2001).

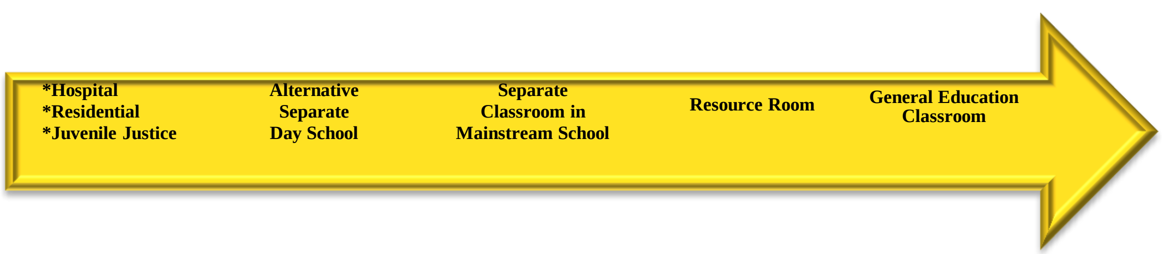
Educational Settings for Students With EBD

In defining the purpose of special education, the 2004 iteration of IDEA requires school districts to provide a free and appropriate education (FAPE) for all students, including those with disabilities. The component of the law that focuses on FAPE meant at that time and still today that school districts could not refuse educational services to any student. Additionally, the stipulation of educating students with disabilities in the least restrictive environment (LRE) increased inclusion of students with EBD in general education classrooms by requiring students with disabilities to be educated with their non-disabled peers to the greatest extent possible. The IDEA (2004) language concerning LRE states:

> To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled, and special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily. (I/B/612/a/5)

In response to LRE mandates, many students with disabilities entered public schools for the first time, but few schools were well prepared to meet their diverse needs, particularly the needs of students with EBD (Kauffman & Landrum, 2012; Smith, 1988). Consequently, students with EBD were not necessarily taught in the same school buildings or classrooms as their non-disabled peers (Osgood, 2008). Teachers taught mainly in isolation, and students whose needs exceeded the reach of classroom teachers' knowledge and skills were referred to special education (Kauffman & Landrum, 2012; Lortie, 1975; Osgood, 2008).

Students with EBD have historically had many challenges with respect to being included in classrooms with their nondisabled peers (Kauffman & Landrum, 2012; Lortie, 1975; Richardson, 1994; Scruggs & Mastropieri, 1995; Wallin, 1922). Educational placements for students with EBD range from hospital/residential facilities to general education classrooms (see Figure 4). On a continuum from most to least restrictive placements for students with EBD, services generally follow this order: hospital, juvenile justice, or residential treatment facility; alternative separate day school; separate classroom in the mainstream school setting; resource room; and general education classroom (Kauffman & Landrum, 2012; Young, 2006).



Adapted from *Characteristics of Emotional and Behavioral Disorders of Children and Youth* (10th ed.), by J. Kauffman & T. Landrum. Copyright 2012 by Guilford Press.

Figure 4: Continuum of Settings From Greatest to Least

Classroom management in public schools has largely transitioned to a proactive, school-wide practice using Positive Behavioral Supports and Interventions (PBIS) model (Myers et al., 2011). However, despite the fact that the majority of all students with mild to moderate disabilities receive their education in the general education classroom (Kavale, 2002), students with EBD are less likely to be included in general education settings than students with other mild to moderate disabilities (Kavale, 2002; Kauffman & Landrum, 2012; Vannest et al., 2009). In its *30th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 2008*, the U.S. Department of Education (2011) stated that 88.9% of students with specific learning disabilities (SLD) receive 40% or more of their education in a general education classroom, compared to only 55.9% of students with EBD who are educated in general education settings. The range of general education classrooms in which students with EBD are included varies. Many of the subjects are extra curricular, such as art or physical education. However, students with EBD have been shown to benefit socially and academically from the cooperative nature of modern science education (McCarthy, 2005).

As the science curriculum emphasizes activities-based approaches, collaboration with peers, and project-based learning, the general science classroom is one of the more engaging content environments in which students with EBD can succeed and improve postsecondary outcomes (McCarthy, 2005; McDuffie et al., 2009). In order for general science educators to include students who have EBD into their classrooms, they need to know critical information about the students to ensure their academic and behavioral success (Kauffman & Landrum, 2012; Regan, 2009). In addition, education in STEM disciplines has increasingly become a national priority (Business Roundtable, 2005; USDOE, 2010). Therefore, a timely opportunity exists for novice educators in the field of science to learn strategies that can support the inclusion of students with EBD in general education settings (Lane & Carter, 2006; Regan & Michaud, 2011; Scruggs & Mastropieri, 2007).

Characteristics of Students With EBD

National Longitudinal Transition Study-2 Results

In an attempt to ascertain the outcome of current services in both general and more exclusionary settings for students with EBD, Wagner and colleagues (2004) examined the characteristics, experiences, and postsecondary outcomes of this population in the National Longitudinal Transition Study-2 (NLTS-2). These researchers examined more than 1,000 youth in the disability category of EBD nationally. The information reported from the NLTS-2 was gathered from parents or guardians via telephone interviews and from mail surveys of staff in schools attended by students with EBD. The outcomes for students presented in the NLTS-2 study reflected aspects of school histories, current school programs, academic performance, and social adjustment (Wagner et al., 2004).

These researchers found that secondary youth with EBD differ from their nondisabled peers in several ways other than their disability. For example, more than three-fourths of youth with EBD are male (Wagner et al., 2004). Other characteristics of youth with EBD that are often associated with poorer outcomes among their nondisabled peers include a higher likelihood of being African American (USDOE, 2012b), living in poverty, and having a head of household with no formal education beyond high school. Data from the study also reflected that youth with EBD, "are less likely to have the advantage of a two-parent household than their nondisabled peers" (Wagner et al., 2004, p. 2). The conditions reported by Wagner and colleagues (2004) are thought to be the foundation on which students with EBD may establish many of the deficits that are brought into their school settings and can be a hindrance to their inclusion in the general education setting.

Behavioral Qualities and Manifestations

The issues presented in the NLTS-2 study are expected for students with EBD when by definition these students have unique behavioral qualities that differentiate them from their peers, and such qualities present challenges to their teachers (Vannest et al., 2009). Teachers who work with students who are EBD need to understand that the behavioral characteristics of this population are categorized as either externalizing or internalizing disorders (Hayling et al., 2008). Characteristics of externalizing disorders include disruption, noncompliance, verbal abuse, aggression, and violence (Kauffman & Landrum, 2012). Students with EBD who exhibit primarily externalizing behaviors are more likely than those who exhibit primarily internalizing behaviors to receive discipline referrals and disciplinary actions and to be educated in self-contained special education classrooms or alternative settings (Furlong, Morrison, & Jimerson, 2007). Characteristics of internalizing disorders include anxiety, depression, social withdrawal, and mood disorders (Kauffman & Landrum, 2012).

Due to their behavioral complexities, students with EBD receive services in exclusionary settings at higher rates than any other special education population other than those with hearing or visual impairment (Shapiro, Miller, Sawka, Gardill, & Handler, 1999; U. S. Department of Education, & Institute of Education Science [USDOE/IES], 2010). This population of students also has higher suspension and expulsion rates than their peers who are disabled or nondisabled (Kauffman & Landrum, 2012; USDOE, 2012a).

Researchers have identified a small number of student-specific factors that appear to influence their successful reintegration into less restrictive educational settings. For example, a correlation exists between low feelings of academic competence and ability with high occurrences of behavior problems for students with EBD (Miles & Stipek, 2006). Researchers have been unable to determine the exact direction of this relationship as they are unsure whether problems with learning, lead to behavior problems, or whether behavior problems, lead to difficulties with learning (Sutherland, Lewis-Palmer, Stichter, & Morgan, 2008). However, one factor is very clear from the research to this point, that students who are EBD typically experience both behavior and academic struggles Kauffman & Landrum, 2012; Vannest et al., 2009).

Academic Outcomes

The duality of the challenges that students with EBD face along with the behavioral and demographic characteristics identified by Wagner and her colleagues (2004) frequently manifest in poor academic outcomes for this population of students. In academic settings, students identified as EBD experience the poorest educational outcomes among any disability group (Kauffman & Landrum, 2012; Landrum, Tankersley, & Kauffman, 2003; Nelson, Benner, Lane, & Smith, 2004; Reid et al., 2004; Vannest et al., 2009). Youth with EBD have been found to possess academic deficits that, at best, remain stable over time (Nelson et al., 2004). Researchers have indicated that students with EBD specifically have significant deficits in the areas of reading, mathematics, and written language (Cullinan, Evans, Epstein, & Ryser, 2003; Mattison, Hooper, & Glassberg, 2002; Nelson et al., 2004). In a meta-analysis of 26 studies concerning the academic success of students with EBD, Reid and colleagues (2004) found the overall mean achievement level among students with EBD at the 25th percentile or less in reading, mathematics, spelling, and written expression. Despite findings of low performance in these four content areas, there remains a relative paucity of studies that examine the academic outcomes of students with EBD in the content area of science (Reid et al., 2004; Ruhl & Berlinghoff, 1992).

What is known about overall performance of students with EBD at the national level is they have the highest dropout rate of any category of disability (Bullock & Gable, 2006; USDOE/IES, 2010). Further, outcomes for students with EBD upon leaving the educational setting often lead to employment difficulties, involvement in the correctional system, limited community interactions, and high rates of involvement in mental health services (Bullis & Yovanoff, 2006; Carter et al., 2009; Lane & Carter, 2006; Wagner, Kutash, Duchnowski, & Epstein, 2005). Exacerbating these circumstances is the fact that the majority of the teachers of students with EBD have not received sufficient preparation to improve the educational or postsecondary outcomes for their students (Brownell et al., 2005; Garland, Vince Garland, & Vasquez, 2013; Rosenberg et al., 2004; Vannest, Harrison, Temple-Harvey, Ramsey, & Parker, 2011).

Preparation of Educators to Serve Students With EBD

Established research on teacher development has shown that early-career teachers have long had feelings of "inadequacy and unpreparedness" (Katz, 1972, p. 51) as well as concerns about classroom management (Burden, 1982; Fuller, 1969; Fuller & Brown, 1975; Katz, 1972). In schools today, students with EBD represent between 2% and 20% of school-age youth and are among the most challenging students to teach (Kauffman & Landrum, 2012; Vannest et al., 2009; Walker, Ramsey, & Gresham, 2004). For such reasons, concerns as well as reluctance to include students with EBD in their classrooms exists among general educators (Larrivee & Cook, 1979; Mastropieri & Scruggs, 2001; Scruggs, Mastropieri, & Boon, 1998).

In a meta-analysis of 28 reports on teacher attitudes and perceptions of inclusion published between 1958 and 1995, Scruggs and colleagues (1998) found that general education teachers perceived students with EBD to be the most challenging of all students with mild to moderate disabilities. The majority of general education teachers supported inclusion, but few were willing to actually participate and include students with disabilities in their own classrooms, stating that they would be unable to meet the needs of the general education students when students with EBD were included (Jolivette et al., 2002; Scruggs et al., 1998). Moreover, when students with EBD are suspended, expelled, or otherwise removed from inclusive settings, teachers were skeptical about their reintegration into such settings (Avramidis, Bayliss, & Burden, 2000; Rock, Rosenberg, & Carran, 1995).

The researchers who publish on the role of teacher attitudes emphasize that teachers need to possess a willingness to connect with students on a personal level (Barr & Parrett, 1995). Students with EBD have stated that they want to know that teachers care about them on a personal level and want them to succeed (Barr & Parrett, 1995). In Crowley's (1993) study of six adolescents with aggressive behaviors in general education classrooms, students described helpful teachers as those who established personal relationships with them, showed a willingness to talk, and had a sense of humor. Students need to believe that teachers recognize their individual strengths and attributes (Parsons et al., 2001). However, Baker and Zigmond (1995) found that general educators who taught students within inclusive settings were less likely than special educators to use interventions that accommodated students with disabilities. Their study also showed that general educators expected students to conform to the instructional style of the teacher rather than educators' adapting their instructional style to the needs of the student (Baker & Zigmond, 1995).

Although models of intervention and corresponding evidence-based practices continue to advance, the promise of new approaches has failed to reach the general population of students with EBD (Kern et al., 2009). In their recommendations for critical educational program components for students with EBD, Simpson and his colleagues (2011) enounced

> There is little reason to believe that most students identified with EBD are currently receiving an education based on effective methods and that all educators who work with these learners are well prepared to use strategies, curricula, and procedures that are associated with the best outcome (p. 231).

Given these circumstances, teachers who have students with EBD must be highly prepared to include them in their classrooms and to ensure a safe and positive learning environment for all (Lane & Carter, 2006; Regan, 2009). Teachers must use preventative approaches to decrease the frequency of problem behaviors and reduce the likelihood of more serious problems occurring (PBIS.org, 2012). Paramount in promoting a positive and inclusive learning environment for students who have EBD is teacher understanding of the critical concepts concerning the use of evidence-based practices (EBPs; Regan & Michaud, 2011; Simonsen et al., 2008; Simpson et al., 2011).

Inclusion of Students With EBD in General Education Science Settings

The integration of EBPs is one way that nationwide education reform is creating opportunities for the inclusion of students with EBD. Each state has developed and implemented standards that are required under the Elementary and Secondary Education Act (ESEA, 1965). However, the standards developed by many of the states do not reflect the knowledge and skills needed by students with disabilities in order to be successful upon graduating from high school (Lane & Carter, 2006; USDOE, 2010). As part of the *Blueprint for Reform*, USDOE (2010) has placed particular emphasis on supporting meaningful educational reform to improve instruction and learning in STEM content in order for the United States to remain a global competitor. Such an emphasis could improve postsecondary outcomes for students with EBD, who have historically had difficulty finding employment after leaving school (Bullis & Yovanoff, 2006; Carter et al., 2009; Lane & Carter, 2006; Wagner et al., 2005).

Although students who have EBD are not specifically mentioned, content area reform has become increasingly mindful of including a broader student population (McDuffie et al., 2009). For example, the National Science Education Standards were developed through a cooperative effort of teachers, school administrators, parents, curriculum developers, college faculty and administrators, scientists, engineers, and government officials (NRC, 2012). The team created the standards with the notation that they need to be dynamic and change in response to our society's needs (NSTA, 2011). On its website, the NSTA strongly supports the *National Science Education Standards* by asserting that

- teachers, regardless of grade level, should promote inquiry-based instruction and provide classroom environments and experiences that facilitate students' learning of science;
- professional development activities should involve teachers in the learning of science and pedagogy through inquiry and integrate knowledge of science, learning, and pedagogy;
- teachers should continually assess their own teaching and student learning;
- assessment practices should be varied and focus on both achievement and opportunity to learn, be consistent with the decisions they are designed to inform, and result in sound and fair decisions and inferences;
- subject matter stress should be on in-depth understanding of unifying concepts, principles, and themes with less emphasis placed upon lower-level skills, such as the memorization of numerous facts;

- inquiry should be viewed as an instructional outcome (knowing and doing) for students to achieve in addition to its use as a pedagogical approach;
- science programs should provide equitable opportunities for all students and should be developmentally appropriate, interesting and relevant to students, inquiry oriented, and coordinated with other subject matters and curricula; and
- science programs should be viewed as an integral part of a larger educational system that should have policies that are consistent with, and support, all *Standards* areas and be coordinated across all relevant agencies, institutions, and organizations (NSTA, 2011).

These standards imply a readiness on the part of the science education professional community to accommodate learners from diverse backgrounds in general education science classrooms, yet what has not been determined is if this diversity statement really embraces students with behavioral or emotional challenges in a traditional science classroom. If such teachers are to stand ready to embrace all students, including students who are EBD, then the academic outcomes for students with EBD might no longer include frustration, academic failure, loss of access to the general education curriculum, and loss of future opportunities in society (Mastropieri et al., 2006; Ruhl & Berlinghoff, 1992).

Although data on how students with EBD perform in science content are limited, the Florida Department of Education has reported that in 2012, only 18% of students with disabilities in the eighth grade were performing at or above achievement level three (satisfactory) on the Florida Comprehensive Assessment Test (FCAT) science exam compared to 19% the prior year. Additionally, only 3% of students with disabilities in grade eight were performing at or above level four on the exam, remaining unchanged from the previous year (Florida Department of Education, 2012). Nevertheless, Scruggs and Mastropieri (2007) stated that students with disabilities could benefit from the study of living and nonliving things, from the direct cause-and effect relationships in nature, and from developing their deductive and inductive reasoning—skills all found in the science curriculum.

Despite the potential benefits of including students with EBD in general education science settings, Cawley, Hayden, Cade, and Baker-Kroczynski (2002) suggested a mismatch between the science curriculum and the needs of students with disabilities. Students with EBD may be less likely than their peers to participate in order to avoid task demands, avert failure, and avoid peer embarrassment when failure occurs (Colvin, 2007; Miles & Stipek, 2006; Scott, Nelson, & Liaupsin, 2001). The manifestation of maladaptive behavior due to academic or social deficits can also impede participation and learning (Colvin, 2004). Therefore, science teachers working with students with EBD need to elicit their engagement and participation in order to ensure their academic success (Bost & Riccomini, 2006; National Science Foundation, 2009; Scruggs & Mastropieri, 2007; Sutherland & Wehby, 2001). Belland, Glazewski, and Ertmer (2009) found that when a student in the seventh grade who had EBD was included in a mainstreamed science classroom and participated with his nondisabled peers in a cooperative, project-based activity, he worked to help his peers overcome their struggles with the assigned task, and his peers did likewise for him.

The issues that accompany the inclusion of students with EBD in general science classrooms present a conundrum. Although students with EBD are substantially underrepresented in science careers due to their difficulties in school, they can learn how to participate in science and science related fields of endeavor (Scruggs & Mastropieri, 2007). The majority of researchers focused on the inclusion of students with EBD in general science settings have stated that the use of hands-on, inquiry-based activities is critical to the engagement of these students in meaningful ways and improves their academic outcomes (Kern et al., 2009; Mastropieri & Scruggs, 1995; Mastropieri et al., 2006; Melber & Brown, 2008; Scruggs & Mastropieri, 1993; Scruggs & Mastropieri, 2007; Scruggs et al., 1998; Vannest et al., 2009).

Because schools are accountable for the academic performance of all students (Rosenberg et al., 2004), teachers need to know how to use effective practices. Science teachers who use proactive behavioral management strategies can save learning time by preventing misbehavior and interruptions of the learning cycle (Colvin, 2007). By mastering the completion of TTC trials, science teachers can manage their classrooms in a manner that reinforces the acquisition of academic and behavioral objectives (Haydon, Conroy et al., 2009; Scheeler et al., 2006). By using practices that reinforce desirable academic and behavioral objectives, teachers can spend more time guiding their students though the curriculum (NSTA, 2011).

Promoting the Use of Evidence-Based Practices for Teaching Students With EBD Among Novice Science Teachers

Educational reformation has affected standards and expectations of general and special educators alike. The No Child Left Behind Act (NCLB, 2001) has dramatically increased the demands that all teachers encounter in the classroom. New teachers need a broad continuum of abilities to teach more complex curriculum to the growing number of public school students who have limited educational resources at home and those who have special needs (Darling-Hammond, 2010). These factors emphasize the need for teacher preparation programs within Institutions of Higher Education (IHE) not only to evaluate the outcomes of the programs, but to assess processes that lead to those outcomes in the name of high quality education for all teachers and their students (Slavin, 2007), particularly with respect to classroom management readiness (Cooper, Kurtts, Baber, & Vallecorsa, 2008; Jones, 2009).

A correlation exists between teacher quality and student academic success (Darling-Hammond, 2010). However, nearly half of all teachers leave the field within five to seven years (Graham & Prigmore, 2009), while it takes approximately three to seven years for teachers to develop skills that enable them to have a positive impact on their students' achievement (Haycock & Hanushek, 2010). Teachers who leave the profession often cite a lack of adequate preparation as one of the reasons for their departure (McKinney et al., 2008). Reschly and Holdheide (2008) found that new teachers who are skilled in evidence-based instruction, classroom organization, and behavior management have the competencies to establish classroom environments conducive to learning and improved academic performance for all students.

In preparing for the reauthorization of the Elementary and Secondary Education Act (ESEA; 1965), the Commission on No Child Left Behind (2007) called for moving beyond the designation of all teachers as "highly qualified" to an assessment as "highly effective" based on student learning evidence (Darling-Hammond, 2010). Among the objectives of the reauthorization of ESEA are to (a) improve teacher and principal effectiveness, (b) provide information to families to help them improve their children's schools and to educators to help them improve their students' learning, (c) implement college and career-ready standards and development of improved assessments aligned with those standards, and (d) provide support and interventions to improve student learning and achievement in the nation's lowest performing schools. The overarching theme of the reauthorization is the emphasis on meeting the needs of diverse learners (USDOE, 2010).

Therefore, the integration of evidence-based classroom management strategies into content pedagogy is integral to preparing teachers for more diverse student populations, including students with EBD (Billingsley et al., 2009; Forlin, Loreman, Sharma, & Earle, 2009). Proactive, evidence-based programs are currently being implemented in school districts nationally (Sugai & Horner, 2006) and disseminated through resources such as pbis.org to support teachers' managing behaviors to improve academic outcomes. However, early career teachers have frequently stated that they are unprepared to address problematic behaviors (Cooper et al., 2008), especially among students with disabilities in inclusive settings (Billingsley et al., 2009; Burden, 1979; Fuller, 1969; Fuller & Brown, 1975; Katz, 1972; Regan & Michaud, 2011).

Teacher preparation programs are in the midst of a paradox in terms of educating teachers to serve students in inclusive classrooms (Brownell et al., 2005). An emphasis on preparation in content knowledge that applies to special education teachers has been explicated in the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004 (Boe, Shin, & Cook, 2007). Alternatively, general education teachers have indicated the need for ongoing professional development in the management of student behavior (Cooper et al., 2008). Many new special educators have conveyed that when it comes to behavior management, they face many of the same challenges as their general educator counterparts (Keller, Brady, & Taylor, 2005; White & Mason, 2006). In a meta-analysis of 17 studies concerning special education teacher induction programs, Billingsley and colleagues (2009) found that new teachers had concerns with behavioral challenges more than in any other area of their jobs. In their recommendations, the researchers promoted the collaboration of general educators and special educators to address the needs of their students with special needs, regular accessibility of mentors to novice teachers who provide constructive feedback, and an increased use of multimedia tools as a means of accessing feedback from mentors.

In order to address teachers' concerns related to behavior management, researchers support the integration of proactive, evidence-based classroom management strategies into teaching routines that increase engagement and improve academic and behavioral outcomes (Conroy, Sutherland, Snyder, Al-Hendawi, & Vo, 2009; Gunter & Jack, 1993; Simonsen et al., 2008). In a literature review of evidence-based practices for classroom management, Simonsen and colleagues (2008) identified five critical features of effective classroom management: (a) maximize structure, (b) post, teach, review, monitor, and reinforce expectations; (c) actively engage students in observable ways, (d) use a continuum of strategies for responding to appropriate behaviors, and (e) use a continuum of strategies for responding to inappropriate behaviors. Simonsen and her colleagues (2008) suggest the use of procedures that incorporate multiple features of effective classroom management to better meet the needs of students who are EBD in the general education setting. One such procedure is called a three-term contingency trial (Albers & Greer, 1991), which includes (a) an antecedent; (b) a behavior; and (c) a consequence (Skinner, 1968).

Three-Term Contingency Trials

Students' behavior and their teachers' instructional method are often interconnected (Greenwood & Abbot, 2001). General education teachers commonly use a lecture instructional format and expect their students to learn passively as the content is presented (Haydon et al., 2009). A limitation of such an approach is that it is an ineffective means of engaging low achievers (Greenwood & Abbot, 2001). Within the context of educating students with EBD, it has been found that a relationship exists between the behavior of teachers and the behavior of students (Sherman & Cormier, 1974). Functional analyses have demonstrated that when appropriate student behavior is followed with teacher attention, the rates of appropriate behavior produced by students increase (Hayling et al., 2008; Sherman & Cormier, 1974; Truesdell & Abramson, 1992). In an early study on the relationship between student and teacher behavior, Klein (1971) found that student behavior had a direct effect on the verbal and nonverbal behavior of the teacher. This finding is important when considering effective practices for teaching students with disabilities (Albers & Greer, 1991), many of whom struggle to engage in appropriate behaviors, particularly among students with EBD (Kauffman & Landrum, 2012).

Many researchers have found that higher achievement on standardized tests was correlated with longer periods of on-task student engagement and greater instructional time (Albers & Greer, 1991; Purkey & Smith, 1983; Rutter, 1983; Wilson, 1987). Literature in behavior analysis has identified features that were functionally related to student behavior change, including (a) increased opportunities to respond (Hall, Delquadri, Greenwood, & Thurston, 1982; Sutherland & Wehby, 2001), (b) diminished transition time (Sainato, Strain, Lefebreve, & Rapp, 1987), (c) rapid instructional pacing (Carnine, 1976), and (d) reduced inter-trial durations (Koegel, Dunlap, & Dyer, 1980). Greer, McCorkle, and Williams (1989) showed a high correlation between the number of trials students with disabilities received and academic success. A variable closely associated with educationally significant rates of correct academic responses among students with disabilities was the opportunity of students to respond (Hall et al., 1982). Another critical component of effective instruction was the teacher's response to the student's response (Albers & Greer, 1991; Klein, 1971).

Applications of behavioral analysis used in clinical settings have provided a foundation for educational practices. Skinner (1968) contributed behavioral analysis to education in the form of programmed instruction. The three components of instruction he used included the (a) antecedent, (b) response, and (c) consequence (Skinner, 1968; Vargas & Vargas, 1991). Greer (2002) identified these interactions as a learn unit. The three components make up the elements of TTC trials: (a) the presentation of an antecedent to the student, (b) student response with an answer, and (c) teacher response to the student with either praise or error correction (Ferkis, Belfiore, & Skinner, 1997; Scheeler et al., 2012). Recommended ratios for delivery of praise statements range from three to four for every corrective statement (Alberto & Troutman, 2012) to six per 15-minute observation session (Sutherland, Wehby, & Copeland, 2000).

Three-term contingency trials "are basic units of instruction in which students learn new behaviors by getting chances to respond and receive feedback on the appropriateness of their responses" (Scheeler & Lee, 2002, p. 233). Three-term contingency trial completion has been found to be a strong predictor of effective instruction in terms of academic and behavioral success (Albers & Greer, 1991; Ferkis et al., 1997). This technique is an essential feature of discrete trial teaching (Ghezzi, 2007), which is an evidence-based practice that is used to modify the behavior of students with autism spectrum disorders (National Professional Development Center [NPDC] on Autism Spectrum Disorders, 2009; Simpson, 2005). What distinguishes TTC trials from discrete trials is the interaction between teachers and students (Goodman et al, 2008).

When implementing the evidence-based practice of TTC, teachers need support to learn the components of this technique (Albers & Greer, 1991; Ferkis et al., 1997; Scheeler & Lee, 2002). A reason to invest the time and resources to ensure fidelity of completing TTC trials is that Scheeler (2008) in her extensive literature review on effective instructional practices found that the completion of TTC trials was one of the top teaching skills in facilitating student achievement. Additionally, by teaching the effective use of TTC trials to teachers, researchers have been able to document a functional relationship between the increased rate of teacher use of TTC trials with students who have disabilities and correct student responses in math and reading as well as improved student behavior (Albers & Greer, 1991; Ferkis et al., 1997).

A critical consideration when teaching novice teachers to use evidence-based practices is getting them to use these practices effectively in their classrooms (Abbott et al., 1999; Boudah, Logan, & Greenwood, 2001; Burns & Ysseldyke, 2009; Fuchs & Fuchs, 2001; Greenwood & Abbot, 2001; Kauffman, 1996; Kennedy, 1997; Scheeler et al., 2009; Shapiro, 2005). Rutherford and Nelson (1988) found that behavior changes in students were frequently not maintained, because the teacher's behavior that produced the change itself was not maintained, resulting in the deterioration of desired student outcomes. Heward (1997) further stated that when teachers are taught a behavior without generalization, they often revert to using techniques that are disparate to those that they initially learned.

Immediate feedback from a supervisor or more experienced expert can aid novice teachers in maintaining effective teaching skills rather than allowing them to deteriorate into ineffective, incorrect techniques that become permanent over time through repetition (Billingsley et al., 2009; Heward, 1997; Scheeler, Ruhl, & McAfee, 2004). Immediate feedback has been used effectively to teach novice educators and their students in the acquisition of new skills (Rock, Gregg, Gable et al., 2009; Scheeler et al., 2010). Immediate feedback has also been used to assist in the generalization of learned best practices into classroom settings (Scheeler, 2008).

Scheeler (2008) identified three factors as key components in helping novice teachers sustain teaching skills learned in the university classrooms during the initial years of teaching:

(1) using immediate feedback to promote acquisition of skills, (2) training and support of novice teachers during the initial years to promote maintenance of behaviors, and (3) increased opportunities for interactions with mentors and feedback in the classroom setting. Immediate feedback alerts the teacher to modify specific teaching techniques and perform them correctly the next time there is an opportunity to do so during instruction (Duchaine, Jolivette, & Fredrick, 2011; Scheeler et al., 2009). Providing immediate feedback has been shown to increase the use of TTC trials among preservice teachers (Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler et al., 2009; Scheeler et al., 2012) and co-teaching teams (Scheeler et al., 2010). Table 2 provides details of studies that have used the coaching of TTC trials among preservice teachers.

Table 2

Studies Incorporating Coaching of TTC Trials Among Novice Teachers

Study	Subjects	Setting	Research question	Design	Outcomes
Albers, A.E., & Greer, R. D. (1991). Is the three-term contingency trial a predictor of effective instruction?	5 junior high school students with LD in math.	Suburban junior high school.	What is the effect of increased TTC on students' correct and incorrect math responses?	Modified multiple baseline; reversal design.	In both studies, increasing the number of TTC trials increased correct response rates while incorrect response rates remained relatively low.
Ferkis, M.A., Belfiore, P.J., & Skinner, C.H. (1997). The effects of response repetitions on word acquisition for students with mild disabilities.	Three third grade reading level elementary school students with LD in reading.	Elementary school.	What are the effects of manipulating the number of response opportunities during a sight word acquisition learning trial?	Alternating treatments design.	Increased opportunities for a response were a function of sight word acquisition.

Study	Subjects	Setting	Research question	Design	Outcomes
Goodman, J. I., Brady, M. P., Duffy, M. L., Scott, J., & Pollard, N. E. (2008). The effects of “bug-in-ear” supervision on special education teachers’ delivery of learn units.	Three novice special education teachers.	Midsize school district in southeast Florida during reading, language, and math content.	(a) Would immediate prompts and feedback to novice teachers via BIE technology increase their accuracy and delivery rates of “learn units” (TTC trials) during instruction, and (b) if increases were observed, would these improvements in accuracy and rate continue when the BIE coaching was faded?	Multiple baseline across participants design.	When a coach delivered immediate feedback using BIE technology, both the rate and accuracy of complete learn units delivered by the teachers increased.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., Bruno, K., Grubb, E., & Seavey, T. L. (2009). Generalizing teaching techniques from university to k-12 classrooms: Teaching preservice teachers to use what they learn.	Exp.#1: Three graduate students majoring in special education. Exp. #2: Two undergraduate seniors majoring in special education.	Large eastern university teaching IEP goals in reading content.	(a) Does training to mastery on one specific teaching behavior (TTC trials) increase sustainability of that teaching behavior across settings, i.e., practicum in a university classroom to student teaching in a public school classroom, and (b) does use of a generalization training package consisting of training to mastery plus training for generalization increase sustainability of teaching behavior across settings, i.e., student teaching setting to public school classroom setting, post-graduation?	Two multiple baseline across participants designs.	(a) Completion of immediate feedback and training to mastery was insufficient to sustain and generalize newly acquired teaching skills, and (b) the combination of immediate feedback, training to mastery, and a plan to promote generalization was effective in maintaining the use of TTC trials.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M.C., Congdon, M., & Stansbery, S. (2010). Providing immediate feedback to co-teachers through bug-in-ear technology: An effective method of peer coaching in inclusion classrooms.	Three dyads, each consisting of a general education teacher and a special education teacher.	Dyad 1 taught in a large rural school district and Dyads 2 and 3, in a large urban school district. Both districts were in southeastern Pennsylvania. All instruction received focused on co-teaching skills.	(a) Does immediate corrective feedback delivered by co-teachers in inclusion settings increase a specific effective teaching technique (i.e., completion of three-term contingency [TTC] trials), and (b) do teachers receiving immediate corrective feedback via BIE technology find this method to be acceptable and practical to use in the classroom while teaching?	Multiple baseline across participants design.	(a) Overall, immediate feedback provided by co-teachers using BIE technology increased the mean percentage of completed TTC trials, and (b) all participants found the intervention to be acceptable.
Scheeler, M. C., & Lee, D. L. (2002). Using technology to deliver immediate corrective feedback to preservice teachers.	Three preservice teachers enrolled in a special education practicum at a large eastern university.	Large eastern university where instruction was given toward the IEP goals of a student with specific learning disabilities in reading.	What are the effects of immediate corrective feedback via BIE on the completion of three-term contingency trials delivered by preservice teachers?	Multiple baseline across participants design.	Immediate corrective feedback was more effective than a traditional delayed feedback procedure in increasing the completion of three-term contingency trials.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., Macluckie, M., & Albright, K. (2008). Effects of immediate feedback delivered by peer tutors on the oral presentation skills of adolescents with learning disabilities.	Four female high school seniors with learning disabilities.	Large regional vocational school in southeastern Pennsylvania, where instruction was given on improving presentation skills.	Does immediate feedback delivered via wireless technology, when combined with peer tutoring, have an effect on the oral presentation skills targeted by students with learning disabilities, and (b) do students who are receiving immediate feedback via wireless technology report being distracted by the device?	Multiple baseline across participants design.	(a) Immediate feedback delivered by peer tutors using BIE technology decreased specific behaviors that interfere with oral presentation skills more effectively than delayed feedback does, and (b) the BIE device is an acceptable, nonintrusive way for peer tutors to provide immediate feedback to tutees.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., McAfee, J. K. Ruhl, & Lee, D. L. (2006). Corrective feedback delivered via wireless technology on preservice teacher performance and student behavior.	Participants were 5 preservice teachers enrolled in a 14-week special education field experience.	A large eastern university field experience took place in a large school within a large urban school district in PK-5 self-contained special education classes in reading, spelling, calendar skills, and math content.	(a) To what extent does immediate, corrective feedback delivered via BIE increase completion of three-term contingency trials delivered by preservice teachers over deferred, corrective feedback, and (b) to what extent does a change in percentage of completion of three-term contingency trials by preservice teachers result in a change in percentage of correct responses by students, and (c) to what extent do preservice teachers and students using BIE wireless technology report being distracted by the device?	Multiple baseline across participants.	(a)Immediate, corrective feedback, delivered via technology increases a specific effective teaching behavior more than deferred feedback, (b) increases in three-term contingency trial completion by teachers results in increased correct student academic responses in students, and (c) the BIE device is an efficient and nonintrusive way to provide immediate feedback to preservice teachers.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance.	Four female and one male undergraduate special education majors enrolled in a three-credit practicum.	Large research university in the northeast who taught reading and math in general education classrooms.	(a) Does immediate feedback delivered via webcam and Bluetooth technology increase a specific, effective teaching technique by preservice teachers in a practicum setting, and (b) to what extent do the participants find the intervention acceptable?	Multiple baseline across participants design.	(a) Immediate feedback delivered via technology increased a specific teaching technique more effectively than delayed feedback, and (b) the intervention is an acceptable, nonintrusive way for observers to provide immediate feedback to teachers from remote locations.

Bug-in-the-Ear Technology

One means of providing novice teachers with immediate feedback and prompting of the use of evidence-based practices is through the use of Bug-In-Ear (BIE) technology (Falconer & Lignugaris-Kraft, 2002; Goodman et al., 2008; Johnson et al., 2013; Korner & Brown, 1952; Ploessl, 2012; Rock, Gregg, Gable et al., 2009; Rock, Gregg, Howard et al., 2009; Rock, Zigmond, Gregg, & Gable, 2011; Scheeler, 2008; Scheeler et al., 2004; Scheeler, Macluckie, & Albright, 2008; Scheeler et al., 2012; Wade, 2010; West & Jones, 2007). Bug-in-the-Ear technology has been used in a variety of educational settings and allows for immediate feedback to novice teachers in order to implement best practices in their classrooms (Ploessl, 2012; Rock, Gregg, Gable et al., 2009; Rock, Gregg, Howard et al., 2009; Scheeler et al., 2006; Scheeler et al., 2012; Scheeler et al., 2004; Wade, 2010). Using BIE, mentors and supervising teachers can covertly observe novice teachers as they teach and provide immediate feedback. (Coulter & Grossen, 1997; Giebelhaus, 1994; Rock, Gregg, Thead et al., 2009).

Korner and Brown (1952) initially introduced BIE as a means to covertly prepare clinical psychologists during practicum and their initial years of practice. Bug-in-the ear technology has since been utilized in several professions, including law enforcement, psychology, and counseling (Franklin, Sexton, Lu, & Ma, 2007; Gallant & Thyer, 1989). Initially, BIE technology consisted of large audio systems that were often intrusive to the immediate environment (Coulter & Grossen, 1997; Giebelhaus, 1994). The technology at that time consisted of FM radio devices with a range of 150 to 300 feet (Herold, Ramirez, & Newkirk, 1971).

Advances in technology now allow coaches, mentors, and supervisors to provide covert immediate feedback to teachers over the Internet at distances spanning hundreds of miles so they can master and maintain evidence-based practices (Rock, Gregg, Gable et al., 2009; Scheeler et al., 2008). Similar to using mixed reality classrooms to prepare teachers to master the use of evidence-based practices (Vince Garland, Vasquez, & Pearl, 2012), BIE has the potential to increase teacher learning in a reduced amount of time. Recent studies in numerous general and special educational environments covering content in math, reading, social skills, and spelling have demonstrated increased facilitation of evidence-based instructional strategies with immediate feedback provided to novice teachers (Franklin et al., 2007; Rock, Gregg, Gable et al., 2009; Rock, Gregg, Howard et al., 2009; Scheeler et al., 2009; Scheeler et al., 2010; Scheeler et al., 2006; Scheeler et al., 2012; Scheeler et al., 2004; Wade, 2010).

Today, BIE uses two major components: an earpiece, and a Bluetooth-enabled device (Scheeler et al., 2012). Web conferencing platforms, such as SKYPE™ and Adobe® Connect™, used in conjunction with BIE technology assist in providing covert evaluation and feedback to novice teachers as they teach (see Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 5; Franklin et al., 2007; Rock, Gregg, Gable et al., 2009; Rock, Gregg, Howard et al., 2009; Scheeler et al., 2006). Adobe® Connect™ was used in this study. Vasquez and Slocum (2012) used the platform to increase the oral reading fluency (ORF) scores of students at risk of reading failure. In their recent evaluation of empirical literature for online instruction for K-12 special education, Vasquez and Straub (2012) recommended that online platforms such as Adobe® Connect™ should be considered as a mechanism for delivery of high quality instruction to teachers who serve students with disabilities.

Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 5: Screen Capture of Virtual BIE Coaching Using Adobe® Connect™ Web Platform.

When reporting on their experiences using BIE, novice teachers shared their experiences to be formative, innovative, and supportive (Giebelhaus, 1994; Rock, Gregg, Gable et al., 2009; Scheeler, 2008). Giebelhaus (1994) conducted a study that found that a supervisor's use of short and specific feedback statements delivered via BIE technology promoted the flow of instruction. The findings supported the research that some student teachers while receiving prompts via Bug-in-the-Ear technology can change ineffective teaching behaviors during the coaching process (Giebelhaus, 1994).

Using this technology, novice teachers receive real-time feedback clinical experiences (Scheeler & Lee, 2002). In contrast to delayed feedback, the ability of supervising teachers to observe and provide immediate feedback provides the opportunity to immediately correct undesirable teacher behaviors as they occur (Colvin, Flannery, Sugai, & Monegan, 2009; Coulter & Grossen, 1997; Franklin et al., 2007). Beginning teachers who received immediate, consistent, and formative feedback from supervising teachers indicated a feeling of support and ability to manage their classroom more effectively (Colvin et al., 2009; Rock, Gregg, Gable et al., 2009; Scheeler, 2008; Scheeler & Lee, 2002; Scheeler et al., 2006; Scheeler et al., 2004). Table 3 details studies that have used BIE to assist in the mastery and maintenance of newly acquired teaching skills.

Table 3

Studies Employing BIE for Mastery and Maintenance of Newly Acquired Teaching Skills

Study	Subjects	Setting	Research question	Design	Outcomes
Goodman, J. I., Brady, M. P., Duffy, M. L., Scott, J., & Pollard, N. E. (2008). The effects of "bug-in-ear" supervision on special education teachers' delivery of learn units.	Three novice special education teachers.	Midsized school district in southeast Florida during reading, language, and math content.	(a) Would immediate prompts and feedback to novice teachers via BIE technology increase their accuracy and delivery rates of "learn units" (TTC trials) during instruction, and (b) if increases were observed, would these improvements in accuracy and rate continue when the BIE coaching was faded?	Multiple baseline across participants design.	When a coach delivered immediate feedback using BIE technology, both the rate and accuracy of complete learn units delivered by the teachers increased.
Ploessl, D. M. (2012). The effects of virtual coaching on co-teachers' planning and instruction.	Three experienced pairs of teachers with limited co-teaching experience.	Three public primary schools in Alabama.	(a) How does virtual coaching affect how co-teachers plan for and carry out varied co-teaching models, student specific accommodations and modifications, and positive behavioral interventions and supports (PBIS), and (b) does virtual coaching impact (i.e., benefit or disrupt) co-teachers and their P-6 students?	Single-case withdrawal (ABAB) within participants design.	(a) All three dyads increased the number of varied co-teaching models they planned to used and then implemented, and (b) all participants indicated that the virtual coaching experience was beneficial for co-teachers and their K-5 students.

Study	Subjects	Setting	Research question	Design	Outcomes
Price, A. T., Martella, R. C., Marchand-Martella, N., & Cleanthous, C. C. (2002). A comparison of immediate feedback delivered via an FM headset versus delayed feedback on the inappropriate verbalizations of a student with ADHD.	10 year-old male student with ADHD, exhibiting a high degree of inappropri-ate verbal-izations.	Public elementary school classroom in a midsized city in the Pacific Northwest during math instruction.	What are the effects of immediate corrective feedback and specific praise, delivered via BIE, as compared to delayed corrective feedback and praise?	Alternating treatments design.	Immediate feedback using BIE is more effective in reducing inappropriate behavior than delayed feedback.
Rock, M. L., Gregg, M., Thead, B. K., Acker, S. E., Gable, R. A., & Zigmond, N. P. (2009b). Can you hear me now? Evaluation of an online wireless technology to provide real-time feedback to special education teachers-in-training.	15 teachers enrolled in a field-based graduate special education teacher preparation program.	12 different schools in six school districts across five counties in the south-eastern United States in elementary general and special education classrooms.	(a) Can recent advances in technology be incorporated to enhance the capacity of traditional BIE, (b) how long does the device need to be used to overcome mechanical or technological issues, (c) are there any differential effects on the behavior of experienced versus novice teachers, and (d) how does use of BIE technology affect student learning?	Mixed methods sequential explanatory strategy.	(a) modern technology has enhanced the capacity of BIE, (b) time for addressing technical issues varied according to district technology support, firewalls, and personal technical skills, (c) BIE can positively influence the classroom behavior of both experienced and beginning teachers, and (d) during the online BIE observation with feedback, the level of academic engagement was consistent with that of high achieving students.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., Bruno, K., Grubb, E., & Seavey, T. L. (2009). Generalizing teaching techniques from university to K-12 classrooms: Teaching preservice teachers to use what they learn.	Exp.#1: Three graduate students majoring in special education. Exp. #2: Two undergradu-ate seniors majoring in special education.	Large eastern university teaching IEP goals in reading content.	(a) Does training to mastery on one specific teaching behavior (TTC trials) increase sustainability of that teaching behavior across settings, i.e., practicum in a university classroom to student teaching in a public school classroom, and (b) does use of a generalization training package consisting of training to mastery plus training for generalization increase sustainability of teaching behavior across settings, i.e., student teaching setting to public school classroom setting, post-graduation?	Two multiple baseline across participants designs.	(a) Completion of immediate feedback and training to mastery was insufficient to sustain and generalize newly acquired teaching skills, and (b) the combination of immediate feedback, training to mastery, and a plan to promote generalization was effective in maintaining the use of TTC trials.
Scheeler, M. C., Congdon, M., & Stansbery, S. (2010). Providing immediate feedback to co-teachers through bug-in-ear technology: An effective method of peer coaching in inclusion classrooms.	Three dyads, each consisting of a general education teacher and a special education teacher.	Dyad 1 taught in a large rural school district and Dyads 2 and 3 in a large urban school district. Both districts were in south-eastern Pennsyl-vania. All instruction received focused on co-teaching skills.	(a) Does immediate corrective feedback delivered by co-teachers in inclusion settings increase a specific effective teaching technique (i.e., completion of three-term contingency [TTC] trials), and (b) do teachers receiving immediate corrective feedback via BIE technology find this method to be acceptable and practical to use in the classroom while teaching?	Multiple baseline across participants design.	(a) Overall, immediate feedback provided by co-teachers using BIE technology increased the mean percentage of completed TTC trials, and (b) all participants found the intervention to be acceptable.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., & Lee, D. L. (2002). Using technology to deliver immediate corrective feedback to preservice teachers.	Three preservice teachers enrolled in a special education practicum at a large eastern university.	Large eastern university where instruction was given toward the IEP goals of a student with specific learning disabilities in reading.	What are the effects of immediate corrective feedback via BIE on the completion of three-term contingency trials delivered by preservice teachers?	Multiple baseline across participants design.	Immediate corrective feedback was more effective than a traditional delayed feedback procedure in increasing completion of three-term contingency trials.
Scheeler, M. C., Macluckie, M., & Albright, K. (2008). Effects of immediate feedback delivered by peer tutors on the oral presentation skills of adolescents with learning disabilities.	Four female high school seniors with learning disabilities.	Large regional vocational school in south-eastern Pennsyl-vania where instruction was given on improving presenta-tion skills.	Does immediate feedback delivered via wireless technology, when combined with peer tutoring, have an effect on the oral presentation skills targeted by students with learning disabilities, and (b) do students who are receiving immediate feedback via wireless technology report being distracted by the device?	Multiple baseline across participants design.	(a) Immediate feedback delivered by peer tutors using BIE technology decreases specific behaviors that interfere with oral presentation skills more effectively than delayed feedback does, and (b) the BIE device is an acceptable, nonintrusive way for peer tutors to provide immediate feedback to tutees.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., McAfee, J. K. Ruhl, & Lee, D. L. (2006). Corrective feedback delivered via wireless technology on preservice teacher performance and student behavior.	Participants were 5 preservice teachers enrolled in a 14-week special education field experience.	A large eastern university field experience took place in a large school within a large urban school district in PK-5 self-contained special education classes in reading, spelling, calendar skills, and math content.	(a) To what extent does immediate, corrective feedback delivered via BIE increase completion of three-term contingency trials delivered by preservice teachers over deferred, corrective feedback, (b) to what extent does a change in percentage of completion of three-term contingency trials by preservice teachers result in a change in percentage of correct responses by students, and (c) to what extent do preservice teachers and students using BIE wireless technology report being distracted by the device?	Multiple baseline across participants.	(a) Immediate, corrective feedback, delivered via technology increases a specific effective teaching behavior more than deferred feedback, (b) increases in three term contingency trial completion by teachers results in increased correct student academic responses in students, and (c) the BIE device is an efficient and nonintrusive way to provide immediate feedback to preservice teachers.

Study	Subjects	Setting	Research question	Design	Outcomes
Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance.	Four female and one male undergrad-uate special education majors enrolled in a three-credit practicum.	Large research university in the northeast who taught reading and math in general education classrooms.	(a) Does immediate feedback delivered via webcam and Bluetooth technology increase a specific, effective teaching technique by preservice teachers in a practicum setting, and (b) to what extent do the participants find the intervention acceptable?	Multiple baseline across participants design.	(a) Immediate feedback delivered via technology increased a specific teaching technique more effectively than delayed feedback, and (b) the intervention is an acceptable, nonintrusive way for observers to provide immediate feedback to teachers from remote locations.
Wade, W. Y. (2010). Increasing novice teacher support in 21th-century classrooms: Induction and mentoring for beginning teachers through bug-in-the-ear technology.	Three female novice general education teachers.	Urban elementary charter school in central Florida during reading instruction.	(a) Does immediate teacher prompting by an instructional coach with Bug-In-Ear (BIE) technology increase the mean rate of specific feedback given to students, and (b) given an increase in mean rate, to what extent does the increased average rate of specific feedback sustain during the maintenance conditions of BIE?	Multiple baseline across participants design.	(a) With the use of BIE, novice teachers increased t feedback provided to students during reading instruction, and (b) teachers who received instructional coaching through BIE technology maintained a higher rate of specific feedback during the maintenance condition and BIE support was removed.

Bug-in-the-Ear technology has been shown to be an effective means of changing student behaviors. In an alternating treatments design, Price, Martella, Marchand-Martella, and Cleanthous (2002) used BIE to give immediate feedback (within 3 seconds) to a ten-year-old boy with ADHD in an inclusive math classroom to successfully reduce the number of inappropriate verbalizations made by the student. Using BIE, Scheeler et al. (2008) provided feedback to four high school senior peer tutors with learning disabilities to improve their oral presentation skills. In elementary general and special education classrooms, Rock, Gregg, Howard et al. (2009) found that the use of BIE technology was effective in increasing academic engagement consistent with that of high achieving students.

Immediate feedback has been shown to improve the acquisition of effective teaching practices as well. In a multiple-baseline study, Scheeler and Lee (2002) conducted a study in which three novice general educators were provided immediate feedback via BIE to determine if its use increased teachers' implementation of TTC trials with male students who had individualized educational programs (IEPs) during reading instruction. The intervention proved effective in increasing the implementation rate of TTC trials delivered by all the teachers and reduced the variability of instructional behavior of one of the participants. Scheeler et al. (2006) conducted a similar study among five pre-service teachers who were enrolled in a special education practicum. During the study, the pre-service teachers received immediate feedback to increase their use of TTC trials among students in an elementary setting across the content areas of reading, spelling, calendar skills, and mathematics. As a result of immediate feedback via BIE, all three teachers reached criterion of 90% of all opportunities to complete TTC trials.

Other studies have used BIE to increase the use of TTC trials. In a multiple-baseline study, Goodman et al. (2008) provided immediate feedback to novice special educators to increase their use of TTC trials during mathematics and reading instruction. In a subsequent study, Scheeler et al. (2012) increased the use of TTC trials among five undergraduate special educators in their teaching practicum during mathematics and reading instruction. Scheeler and her colleagues (2009) also used BIE to assist undergraduate and graduate special education students in generalizing teaching skills learned at their university to K-12 settings.

In a later study, Scheeler and her colleagues (2010) used BIE to increase the use of TTC trials among co-teachers. Similarly, Ploessl (2012) also used BIE with co-teachers, focusing on increasing their planning time and varying their co-teaching models. Another classroom application of BIE was conducted by Wade (2010), who used BIE to increase the rate of specific feedback that novice general educators gave to their students during reading instruction. Although BIE has been used to successfully change the behaviors of students and their teachers, there are no studies thus far that have reported on the use of BIE in inclusive science classrooms. This study seeks to increase the rate of TTC trials among novice science educators with their students who have EBD in their classrooms via BIE.

Since classroom management is a critical skill (Oliver & Reschly, 2010), dealing with disruptive behavior can be time consuming and stressful for new teachers (Jolivette et al., 2002). In addition, some students with behavioral issues have difficulty perceiving their own counterproductive behaviors, and feedback at the end of class may be too late (Duchaine et al., 2011). At the same time, positive classroom behaviors are not always recognized and reinforced (Scheeler et al., 2006). Early career teachers need support in managing the behaviors of students in an inclusive science classroom in order to ensure highly accessible and engaging content (Regan & Michaud, 2011). Learning to master the completion of TTC trials is one evidence-based strategy known to have positive academic and behavioral outcomes (Albers & Greer, 1991; Scheeler et al., 2006). Virtual coaching and immediate feedback delivered via BIE could serve as a dynamic learning model for novice teachers because the supervisor can adapt the feedback to the contextual demands of the classroom environment experienced by the teacher (Rock, Gregg, Thead et al., 2009; Scheeler, 2008). Novice science teachers could benefit from the discreet support of a virtual coach to optimize the likelihood of increasing academic and behavioral performance among their most challenging students, students labeled EBD (Rock, Gregg, Howard et al., 2009; Scheeler et al., 2006).

CHAPTER THREE: METHODOLOGY

Chapter Overview

The purpose of this research study was to measure the effectiveness of providing immediate feedback to novice science educators who had students with emotional and behavioral disorders (EBD) in their classrooms on their use of three-term contingency trials (TTC) via Bug-in-the-Ear (BIE) technology. In this chapter, research questions are presented, followed by an overview of the investigation. The overview includes the research design, a description of the participants and the settings, materials, and procedures for the study. Additional information provided includes the materials and instrumentation, dependent measures, experimental procedures, research design, treatment integrity, and social validity. The chapter concludes with a description of validity and reliability procedures used in the investigation.

Research Questions

The investigator examined the effectiveness of providing immediate feedback via BIE to novice science teachers to increase their completion of TTC trials among students identified as having EBD in their classrooms. Specifically, the investigator sought to answer the following research questions:

(1) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the percentage of completed TTC trials;

(2) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the rate of correct student answers; and

(3) Will the teachers maintain their newly learned behaviors when the intervention is removed?

Research Design

Multiple Baseline Across Participants

The investigator used a single-subject multiple-baseline-across-participants design (Gast, 2010) to evaluate the effects of providing immediate feedback via BIE technology to novice science teachers on their use of TTC trials while they taught students labeled EBD in their classrooms. The study compared three conditions: (A) baseline, (B) treatment, and (C) maintenance (Kazdin, 2011; Lane, Wolery, Reichow, & Rogers, 2007). A single-subject research design was chosen because the design allows for the participants to serve as their own comparison (Scruggs, Mastropieri, & Castro, 1987; Tankersley, Harusaola-Webb, & Landrum, 2008) and has been found to be particularly useful in defining educational practices at the individual level (Gast, 2010; Horner et al., 2005). Furthermore, single-subject designs have been considered to be philosophically parallel to special education's core principles of individualized instructional decision-making and frequent monitoring of student progress (Tankersley et al., 2008). This single-subject study examined in depth how the intervention affected the relationship between teacher behavior and the student behavior.

Participants' performances were measured using the TTC Data Collection Sheet (see Appendix C) that was used in a recent study by Scheeler et al. (2012). Participants were taught to complete all of the components of TTC trials as described by Albers and Green (1991) and Scheeler et al. (2012) and received immediate feedback via BIE during the intervention condition (see Appendix I) of the study once stability of data was ascertained during the baseline condition (see Appendix J; Kazdin, 2011). The components of TTC trials that teachers were mentored to master were (A) the teacher's providing the student with an opportunity to respond, (B) the student response, and (C) the teacher's providing either corrective feedback or praise (Albers & Green, 1991). The establishment of stable baseline data and subsequent increases in the percentage of completed TTC trials following the intervention of immediate feedback via BIE allowed the following conclusions to be supported: (a) observed effects were likely due to the intervention and not an external variable that may have occurred, and (b) repeated exposure to baseline conditions did not affect performance (Gast, 2010).

The documentation of experimental control in a multiple-baseline design was achieved through the staggered introduction of the independent variable at different points in time (Cooper, et al., 2007; Horner et al., 2005). Replication across participants allowed for increased internal validity, experimental control, and demonstration of a functional relationship between the dependent and independent variables (Horner et al., 2005; Kazdin, 2011). This research study had three conditions: Condition 1, baseline; Condition 2, intervention; and Condition 3, maintenance. Three sessions were conducted concurrently with each of the participants at the beginning of the study. Recorded data (see Appendix C) were graphed for visual analysis (Gast, 2010; Horner et al., 2005).

Combination of Non-overlap and Trend: Tau-U

Non-overlap indices are based on comparisons of individual data points across two conditions, and have been widely used during single case research for determining treatment effects (Kazdin, 2011, Parker, Vannest, & Davis, 2011). However, the majority of non-overlap methods are insensitive to positive baseline trend (Parker, Vannest, & Davis et al., 2011), thereby limiting the ability to inference effect size determination. Parker, Vannest and Davis (2011) recommended that two data characteristics should preclude the implementation of simple non-overlap methods: (a) presence of positive trend in the baseline condition, and (b) presence of strong improvement in the intervention phase, which captures only an index of level.

Tau-U is a flexible, powerful new index of statistical analysis of data in single-case research (Parker, Vannest, & Davis, 2011). The analysis combines non-overlap between conditions with the trend from within the treatment condition. The method of analysis is derived from Kendall's Rank Correlation (KRC) and the Mann-Whitney U. Tau-U controls for monotonic (upward) baseline trend, and through the integration of nonparametric tests such as the Mann-Whitney U and KRC, offers a sound validation for non-overlap as sensitive and powerful measure of effect size (Parker, Vannest, & Davis, 2011). According to Parker & Vannest (2012), Tau-U:

> is perhaps the most flexible ES index for bottom-up analysis. First, it is nonparametric, distribution-free, and suitable for data with any distribution shape and for any type of scale. Second, it has strong statistical power (at least 91–95 % that of Ordinary Least Squares regression), so is suitable for even short data series. Third, it permits statistical control of potentially confounding baseline trend, if it exists. Fourth, it is congruent with traditional visual analysis, as it is based on data non-overlap between phases. (p. 259)

The Tau-U summary index is interpreted as "the percent of data that improve over time considering both phase nonoverlap and Phase B trend, after control of Phase A trend" (Parker, Vannest, & Davis (2011, p. 291). Scaling of effect size for Tau-U follows the same conventions as Cohen's d for regression and correlation analyses (Cohen & Cohen, 1983). Tau-U analyses were conducted on the data for the teachers' percentage of completed TTC trials and the students' number of correct answers per minute- research questions one and two, respectively. Results were generated using the Tau-U Calculator (Vannest, Parker, & Gonen, 2011) and provide insight into the effect of the intervention with the participants.

Participants

For this study, a convenience sample of three novice general education secondary science teachers from a large suburban public school district agreed to participate in this study. The investigator solicited the participants via the school district science content administrator. The investigator sent a letter explaining the study to the district administrator, who subsequently sent emails to the secondary STEM coaches in the district schools, and copied the investigator on those emails. At the time of the study, two of the teachers held a master's degree, and one held a bachelor's degree. None of the degrees held by the teachers was in the area of science education. Criteria for teachers to participate were: (a) participants must be novice science teachers, and (b) participants must have at least one student identified as receiving services under the IDEA (1997) for EBD. The investigator sent follow-up emails to the STEM coaches, offering to call them or meet them personally to explain the study in greater detail.

Of ten STEM coaches contacted, one communicated to the investigator she knew of a teacher who fit the criteria and was willing to participate in the study. That teacher later contacted the investigator to make arrangements to be the first participant. The investigator contacted the third participant whom he had previously supported as a new teacher during the teacher's enrollment in a graduate program for STEM education. The teacher had subsequently stopped taking courses due to feelings of being overwhelmed. The teacher agreed to participate in the study, stating that he had a need for classroom management support. The third participant was contacted via the principal at an area ninth grade district school. The principal communicated with the investigator that he had a new biology teacher that needed support with classroom management. The teacher later contacted the investigator and agreed to be the third participant.

All of the participants reported that they did not have any formal training in behavior management. All of the participants reported that they taught students with disabilities in their classroom, but that they had not seen an individualized educational program (IEP) for any of their students. The teacher participants all stated that they only had difficulty managing classroom behaviors, especially among particular students during specific classroom periods. Student data were ascertained at the onset of the study.

The participants will hereafter be referred to as teachers. Each teacher was given a brief questionnaire (see Appendix E) to obtain a description of themselves, their students, their classroom environments, and their daily routine. Table 4 delineates the number of years of teaching experience of each participant, their previous career, age, ethnicity, and gender as well as the number of students with EBD in each participant's class.

Table 4

Descriptions of Teachers

Name	Grade level	Years teaching	Previous career	Age	Ethnicity	Gender	No. of students in class	Students w/ EBD	Behavior mgt. training?
Eliza	7	2.5	Early childhood teacher	29	Caucasian	Female	23	1	No
Katherine	9	.5	Athletic trainer	24	Caucasian	Female	24	1	No
Tom	6	.5	Biologist	24	African American	Male	23	1	No

Teacher One

Teacher one was Eliza (pseudonym). She is Caucasian and had taught in elementary settings prior to teaching at the middle school in which she taught during the study. At the time of the study, Eliza had been teaching for two-and-a-half years. Eliza taught seventh-grade science content during her third-period class. In this class period was Steven (pseudonym), a student identified as receiving services for EBD. Eliza had no co-teacher or paraprofessional during the time which Steven received science instruction. Eliza had no coursework or professional development in behavior management prior to participating in the study.

Teacher Two

Teacher two was Katherine (pseudonym). Katherine is Caucasian, and was an athletic trainer prior to teaching in the high school in which she taught during the study. At the time of the study, Katherine had been teaching for less than one year. Katherine taught ninth-grade biology during her sixth-period class. In this period was Lamar (pseudonym), a student identified as receiving services for EBD. Katherine had no co-teacher or paraprofessional during the time which Lamar received science instruction. Katherine had no coursework or professional development in behavior management prior to participating in the study.

Teacher Three

Teacher three is Tom (pseudonym). Tom is African American, and was a biologist prior to teaching in the middle school in which he taught during the study. At the time of the study, Tom had been teaching for less than one year. Tom taught sixth-grade science during his third-period class. In this class period was Bruce (pseudonym), a student identified as receiving services for EBD. Tom had no co-teacher or paraprofessional during the time which Bruce received science instruction. Tom had no coursework or professional development in behavior management prior to participating in the study.

Student Population

Table 5 provides details of the students with EBD in the classrooms of the teachers. Included are the student names (pseudonyms), their ages, ethnicities, genders, and maladaptive behaviors identified by the students' respective IEPs. Despite these behaviors' being listed on the students' IEPs, the teachers had not seen the IEPs of their students labeled EBD prior to the initiation of the study. Therefore the specific maladaptive behaviors identified in Table 5 were not targeted.

Table 5

Descriptions of Students

Name	Age	Gender	Ethnicity	Behavior(s)
Steve	13	Male	Hispanic	Noncompliance, aggression, off-task, incomplete work
Lamar	15	Male	African American	Noncompliance, tardiness, withdrawal
Bruce	13	Male	African American	Noncompliance, verbal outbursts, defiance

Note. The science teacher ascertained all student information and protected student identities.

Student One

Student one was Steven (pseudonym). Steven was a male and was 13-years-old at the time of the study. Steven had been diagnosed with oppositional defiance disorder and was receiving services under IDEA for EBD. In her participant inventory (see Appendix E), Eliza described Steven as having strengths in being on time with materials and experiencing challenges with participation, off-task behavior, and completing his work.

Student Two

Student two was Lamar (pseudonym). Lamar was a male and was 15-years-old at the time of the study. Lamar had been diagnosed with a mood disorder and was receiving services under IDEA for EBD. In her participant inventory (see Appendix E), Katherine described Lamar as having strengths in writing and drawing and challenges in participation, tardiness, and completing his work.

Student Three

Student three was Bruce (pseudonym). Bruce was a male and was 13-years-old at the time of the study. Bruce had been diagnosed with oppositional defiance disorder and attention deficit hyperactivity disorder and was receiving services under IDEA for EBD. In his participant inventory (see Appendix E), Tom described Bruce's strengths as knowing the material covered in class and his challenges in following instructions, talking out of turn, and arguing.

Settings

Observations for this study took place via the Adobe® Connect™ web conferencing platform over the Internet. The teachers were teaching in their classrooms, which were secondary schools in a large southeastern public school district. At the time of the study, the school system operated 182 schools (123 elementary, 3 K-8, 35 middle, 19 high, and 4 exceptional learning). In October 2012, the district had 183,562 students, making it the fourth largest school district statewide and eleventh in the nation. The 2010 U. S. Census reported a population of 1,145,956. The racial makeup of the school district was 526,754 (46.0%) White, 223,200 (19.5%) African American, 2,449 (0.2%) Native American, 55,541 (4.9%), Asian, 1,038 (0.1%), Pacific Islander, 6,278 (0.6%) from other races, and 22,452 (2.0%) from two or more races. Hispanic or Latino of any race was 308,244 persons (26.9%). The median income for a household in the district was $41,311, and the median income for a family was $47,159. About 8.80% of families and 12.10% of the population were below the poverty line, including 16.30% of those under age 18.

Observations were conducted during the class periods in which students with EBD were present in three schools within the district. Schedules were arranged with the teachers in advance to allow for any time overlap in the event that there would be more than one of the teachers instructing students with EBD at the same time. This issue did not arise as a problem within this study.

School One

School one was a middle school and was located in the eastern region of this large suburban school district. The school had 1,059 students. The percentage of students receiving free or reduced lunch was reported by the district to be at 78%. Figure 6 provides demographic information of the students at school one.

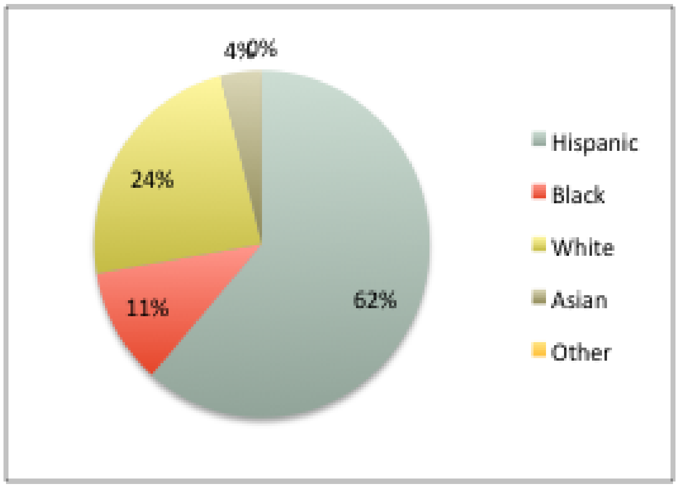


Figure 6: Student Demographics of School One.

Classroom One

Classroom one was located in the science building of school one. The physical arrangement of the classroom consisted of science lab tables that seated two students each, counters and cabinets along two walls, a teacher desk, an interactive white board, ceiling-mounted projector and speakers, a demonstration table, and sinks. Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 7 provides details of the view from the web camera in classroom one. The science content that was taught during the time that Steven was present was seventh-grade science. Instruction occurred during third period, which took place from 11:16 a.m.to 12:10 p.m., when there were 23 students total in the classroom. The typical routine of instruction included a written warm up activity during the first five minutes, followed by direct instruction, and labs and interactive lessons on the white board.

Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 7: View From the Web Camera in Classroom One.

School Two

School two was a high school and was located in the north region of this large suburban school district. The school had 1,876 students. The percentage of students receiving free or reduced lunch was reported by the district to be at 42%. Figure 8 provides demographic information of the students at school two.

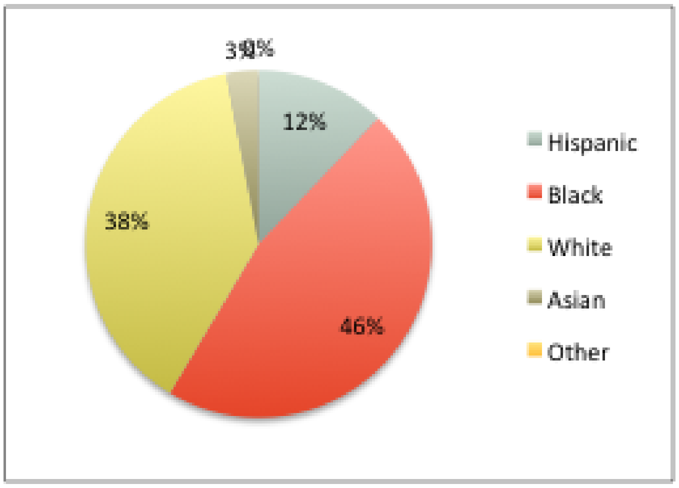


Figure 8: Student Demographics of School Two.

Classroom Two

Classroom two was located in the science building of school two. The physical arrangement of the classroom consisted of two walls on which cabinets, counters, and sinks were installed, a wall with windows, science lab tables at which two students could sit, an interactive white board, and a ceiling-mounted projector and speakers. Figure 9 provides details of the view from the web camera in classroom. The science content that was taught during the time that Lamar was present was biology. Instruction occurred during sixth period, which took place from 12:29 p.m.to 1:19 p.m., when there were 24 students total in the classroom.

Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 9: View From the Web Camera in Classroom Two

School Three

School three was a middle school and was located in the north region of this large suburban district. The school had 1,058 students. The percentage of students receiving free or reduced lunch was reported by the district to be at 79%. Figure 10 provides demographic information of the students at school three.

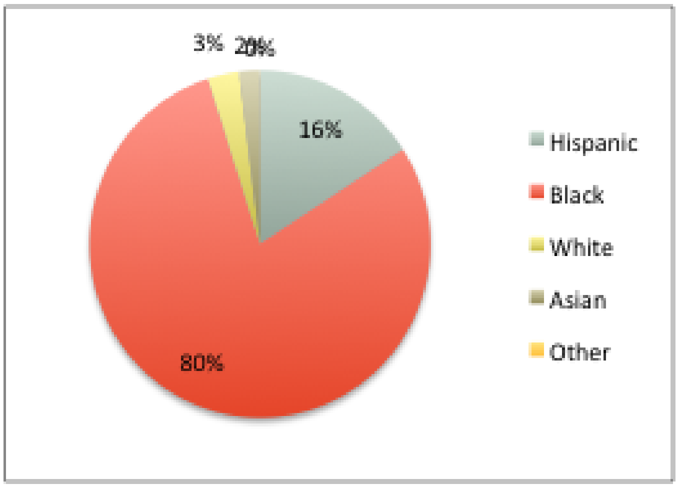
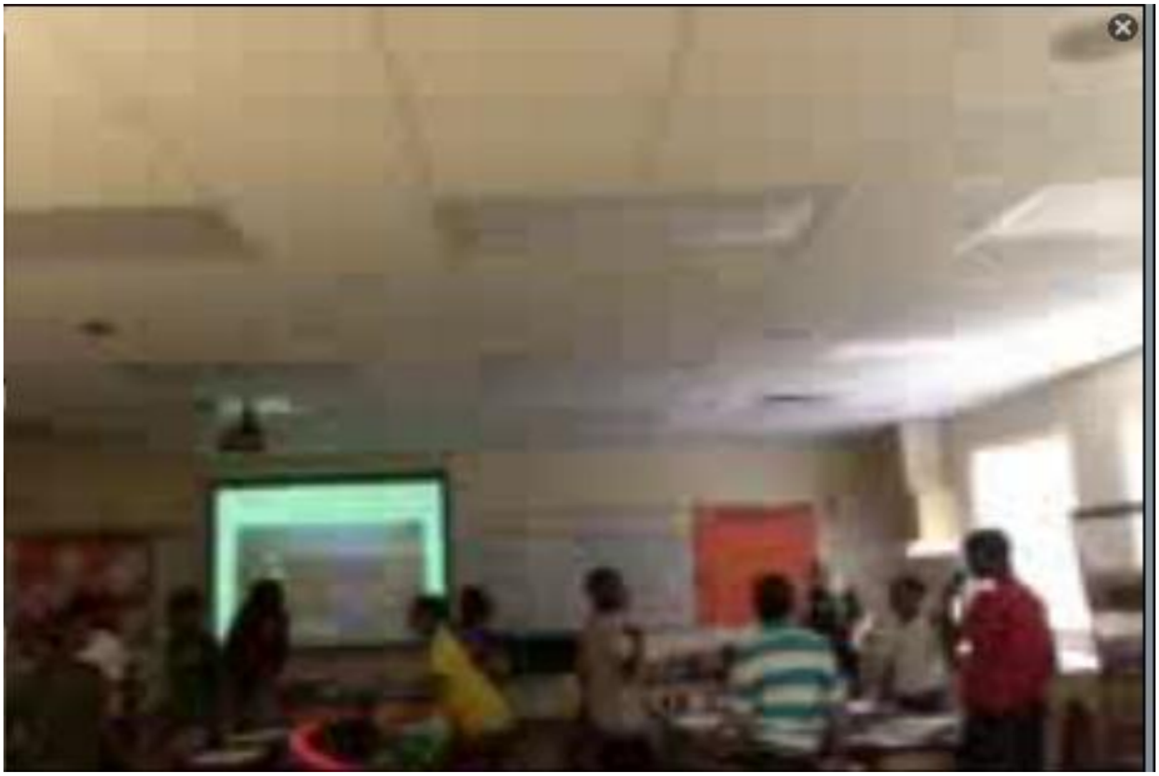


Figure 10: Student Demographics of School Three.

Classroom Three

Classroom three was located in the science building of school three. The physical arrangement of the classroom consisted of one wall on which cabinets, counter tops, and sinks were installed, one wall with windows, book shelves, and tables with student computers, science tables at which two students could sit, a teacher desk with two individual student desks nearby, a ceiling-mounted projector, and dry white board. Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 11 provides details of the view from the web camera in classroom three. The science content that was taught during the time that Bruce was present was sixth-grade science. Instruction occurred during fifth period, which took place from 1:23 p.m. to 2:08 p.m., when there were 23 students total in the classroom.



Adobe product screenshot(s) reprinted with permission from Adobe Systems Incorporated.

Figure 11: View From the Web Camera in Classroom Three.

Materials

During data collection, Scheeler et al. (2012) used the TTC data collection sheet (see Appendix C) to document the antecedents given by the teacher, correct and incorrect student responses, consequences given by the teacher in the form of error correction or specific praise, and feedback of the researcher in a similar study using BIE technology. In this study, the researcher used the TTC data collection sheet (Scheeler et al., 2012) for the same purposes in order to replicate the Scheeler et al. (2012) study as closely as possible. Other materials that were used in each condition of the study included a Macintosh laptop computer that was equipped with a web camera, and a Logitech H340 headset with noise cancelling microphone that were used by the investigator.

Previous studies involving BIE technology (Rock, Gregg, Thead et al., 2009; Scheeler et al., 2012) involved the use of Bluetooth wireless earpieces that were routed, or “paired” to the teachers’ desktop computers. Once paired, the earpieces were the default computer speakers, and served as the means by which the teachers received immediate feedback from the researchers. They were also the default computer microphones, by which the researchers heard the teachers as they communicated with the teachers over the Skype web communication platform.

In this study, each of the participants taught from an interactive media-based science curriculum in their classrooms that required the use of ceiling-mounted speakers as default speakers for instruction that occurred from the computer (e.g., videos). Lessons conducted by the teachers during the study incorporated the use of short videos and interactive quizzes that were shown on the interactive white boards or video screens and heard over the ceiling-mounted speakers. Consequently, the teachers’ computers could not be paired to the Bluetooth earpieces that they wore. In addition, the availability of additional technology from each school was limited. Accordingly, the makeup of the Bug-in-the-Ear technology used by each teacher was improvised and varied, resulting in a “bring your own device” (BYOD) model.

During the preliminary meetings with the participating teachers, the investigator provided each of the teachers with Bluetooth earpieces, USB Bluetooth adapters for the earpieces, and web cameras. Once the researcher determined that there was a need to improvise the BIE technology, Eliza was able to obtain the use of an iPad2 from her school. The iPad2 tablet was

Bluetooth enabled and equipped with a web camera. The investigator paired the Plantronics M20 Bluetooth earpiece to the iPad, making it the default audio device.

Katherine used her Dell classroom teacher's computer to access the Adobe® Connect™ platform. The investigator attached a Creative LiveCam Optia Pro web camera to her computer so she could be viewed in the virtual classroom. Katherine was unable to obtain additional technology from her school. She mentioned that she had a new iPhone, but feared that a student would steal it. Therefore, the investigator provided Katherine with a Bluetooth-enabled Verizon Samsung Gusto 2 pre-paid cellular phone for audio communication with the investigator. Ten minutes prior to scheduled observations, the investigator sent a reminder email to Katherine. When she logged into the Adobe® Connect™ platform, the investigator then called Katherine and established audio connection.

Because Tom could not obtain additional technology to use during the study, he used his personal iPhone 4. His phone was Bluetooth enabled and had a camera as well as the ability to access the virtual classroom via the Internet. Tom also wore the Plantronics M20 earpiece provided to him for communicating with the investigator. The investigator paired the earpiece with Tom's iPhone.

Audio and video quality varied across teachers and their technologies. The best video quality came from Katherine's web camera that was plugged into her classroom computer (see Figure 9). Video quality from the iPad used in Eliza's classroom (see Figure 7) was superior to that from the iPhone used in Tom's classroom (see Figure 11). Audio reception was of equivalent quality across the teachers' classrooms.

The investigator observed the teachers and provided coaching on TTC using the Adobe® Connect™ platform. This platform was chosen because it allows for real time audio, video, and chat interactions among users, and enables conference sessions to be recorded. In addition, Adobe® Connect™ was the preferred platform because of its versatility across mobile devices (Vasquez & Slocum, 2012) and its ability to be used on any Internet service plan. In the current study, Adobe® Connect™ was used as a medium of exchange while delivering immediate feedback through BIE technology, rather than Skype, as noted in earlier research (Rock, Gregg, Howard et al., 2009). A visual quick start guide for using the Adobe® Connect™ platform (see Appendix F) was provided to each participant during the pre-baseline meeting. Student responses across all three conditions were calculated based upon the responses from all of the students present in the teachers' classrooms, including students labeled EBD.

Procedures

Pre-Data Collection

Prior to beginning the study, the investigator obtained IRB approval from his research institution (see Appendix M). The investigator then met with the supervising administrator of each teacher to explain the nature of the study and what exactly would take place. Upon receiving the approval of their respective administrators, the investigator met with teachers in their respective classrooms to assess the technology within each setting. During the preliminary conferences, each teacher was asked not to discuss the study with anyone and was also advised of the investigator's availability for assistance throughout the duration of the study. At the same meetings, the investigator provided each teacher with the technology that was needed to conduct the study and trained each teacher on the use of BIE for the study (see Appendix K). The investigator then provided each teacher with a link to a conference session on the Adobe®

Connect™ platform to test for connectivity so that the teachers would be comfortable with navigating the use of the application with BIE.

During pre-baseline meetings, each teacher wore the earpiece in the "on" position and signed into the Adobe® Connect™ virtual classroom. The investigator moved to an adjacent classroom and logged onto his laptop computer, to which a Wi-Fi signal was sent from his cell phone. The investigator then signed into the Adobe® Connect™ virtual classroom, enabled the audio and video on his computer and waited for the teacher's name to appear in the participant window of the virtual classroom.

When the teacher's name appeared in the participant window, the investigator designated the teacher the host of the virtual classroom to give her/him video and audio privileges. Once given such privileges, the teachers enabled their web cameras and microphones (the Bluetooth earpieces). After these steps were completed during each meeting, the investigator asked the teachers to position the web camera so that it captured the greatest amount of area in each classroom.

Once video setup had been arranged, the investigator asked each teacher to walk to the four corners of her or his classroom while they talked to ensure a clear audio connection in the Bluetooth earpiece. After audio and video connections were established, the investigator and the participants determined observation schedules. The investigator told each participant that he would send a text message ten minutes prior to the observations as a reminder. He also asked that each of them wear the Bluetooth earpiece in the "on" position during all conditions of the study. He told them that no prompting from the investigator would be given during the baseline condition.

The test session also allowed each teacher to familiarize her/himself with using the Bluetooth earpiece. The investigator showed the teachers how to wear the earpieces and turn them on and off. In addition, each teacher was asked to complete the *Participant Inventory* (see Appendix E) to obtain demographic information about them and their students with EBD. Each pre-baseline meeting took approximately one hour.

Baseline Condition

Baseline observations began according to the schedule arranged between the investigator and the teachers. During the baseline condition (see Appendix I), the teachers signed into the Adobe® Connect™ virtual classroom via the link provided by the investigator. Once the investigator had audio and video connections with the teacher, he said, "Say yes if you can hear me." Upon hearing the reply of "yes," the investigator said, "thank you, we are live." The participants wore the Bluetooth earpiece but received no coaching or feedback during the baseline condition. The teachers' wearing of the Bluetooth earpiece was the only change from the prevailing conditions of their environments during the collection of baseline data (Lane et al., 2007).

Throughout the study, each teacher conducted her or his classroom instruction as was done prior to the initiation of the study. The investigator viewed each teacher via the web camera from the position that was determined during the pre-baseline meetings and recorded data during the scheduled baseline sessions on the TTC Data Collection Sheet (Scheeler et al., 2012; Appendix C). Baseline sessions were a minimum of fifteen minutes in length to a maximum of twenty minutes each (Scheeler et al., 2012). Two sessions took place per scheduled observation date.

Baseline condition data were recorded using a pencil and the TTC Data Collection Sheet (Scheeler et al., 2012; Appendix C). The investigator and a trained observer scored 30% of the sessions for inter-observer agreement (see Appendix B). After five baseline sessions, the investigator examined the data to determine the most stable teacher data and introduced that teacher into the intervention condition (see Appendix K).

Based upon visual analysis of participants' sessions for trends in stability levels, all of the participants had completed zero percent of TTC trials. Therefore, the name of each participant was written on a 3"x5" card, which was folded into quarters, and placed into a hat. The first card that was drawn was Eliza (assumed name), and she was brought into the treatment condition on the sixth session (Horner et al., 2005; Parker et al., 2011; Parsonson & Baer, 1978). Arrangements were made with the other participants for additional baseline session probes while intervention occurred with Eliza. Random selection was also used to determine the next intervention participant.

Treatment Condition

Treatment condition data were recorded on the TTC Data Collection Sheet (Scheeler et al., 2012; Appendix C). The investigator and a trained observer scored 30% of the sessions for inter-rater reliability (see Appendix B). When Eliza demonstrated proficiency in learning to at least 90% of completed TTC trials for a minimum of five sessions, the next participant entered the treatment condition, again based upon baseline data stability (Cooper et al., 2007).

As with Eliza, the remaining two participants in the baseline condition completed zero percent of TTC trials. The same procedure that was previously used to determine who would enter into the treatment condition was again implemented, and Katherine (assumed name), began treatment in session 11. Katherine demonstrated proficiency in learning to at least 90% of completed TTC trials for a minimum of five sessions, and Tom entered treatment on session 16. If none of the participants reached criterion of 90% after five sessions in the treatment condition, a re-teaching of the definitions and steps associated with completing TTC trials would have been conducted (Cooper et al., 2007).

During treatment, all conditions were the same as baseline, except that the teachers received immediate feedback via BIE. Short prompts such as “remember to praise,” “correct the error,” and “be specific” were used to minimize teacher distraction. Similarly to the baseline condition, treatment data were recorded on the TTC Data Collection Sheet (Scheeler et al., 2012). Treatment sessions were 15 minutes long. As in the baseline condition, two sessions took place during scheduled observation dates. Thirty percent of the treatment sessions were observed and scored by the investigator and a trained observer for inter-observer agreement. Should any interruptions of instruction have occurred for over 2 minutes or if the targeted students were absent, the session either ended or was rescheduled, as was done in the study conducted by Wade in 2010. There were no occasions that a session ended or was rescheduled in this study. However, observations were not scheduled during days on which testing occurred.

Because the number of opportunities for TTC trials varied across teachers and sessions, the number of completed TTC trials delivered was divided by the total number of opportunities to deliver TTC trials per session (complete trials + incomplete trials) and multiplied by 100 to determine a percentage for each session. Treatment was terminated after each participant demonstrated mastery of delivering TTC trials at 90% or above on the TTC Data Collection Sheet (Scheeler et al., 2012) for a minimum of five sessions in a row (Gast, 2010). The teachers then entered the maintenance condition of the study.

Maintenance Condition

Maintenance condition data were recorded on the TTC Data Collection Sheet (Scheeler et al., 2012; Appendix C). The investigator and a trained observer scored 30% of the sessions for inter-observer agreement (see Appendix B). During the maintenance condition, the investigator met with each teacher during the respectively scheduled observation times. The maintenance condition differed from the treatment condition in that feedback was faded to each participant (Scheeler et al., 2012) by (a) having the participant turn off the BIE device, but continue to wear it in maintenance sessions one and two; (b) having the participant physically remove the device, but keep it in view during sessions three and four; and finally (c) having the participant remove the BIE from view during session five. After the conclusion of data collection, Eliza had been observed for 20 sessions, Katherine 23 sessions, and Tom 24 sessions, respectively

Post-Treatment Assessment

The use of single-case research is a valued means of identifying evidence-based practices in special education (Horner et al., 2005). Visual inspection of graphed data is the primary means by which analysis occurs when single-subject (within-subject replication) research designs are used (Barton, Reichow, & Wolery, 2007). In this study, evaluation of dependent measures included systematic visual analysis of graphically represented data that were collected (via an Excel spreadsheet) for each participant across conditions, i.e., probes, treatment, maintenance, and generalization (Parsonson & Baer, 1978).

The visual interpretation examined the level, trend, and variability of performance across conditions regarding the percentage of completed TTC trials (see Appendix A) on the part of teachers and their students with EBD (Kazdin, 2011). Student data included correct responses during direct instruction. Tau-U analysis of non-overlap and trend of data was used to demonstrate effects of the treatment on the dependent variables (Parker et al., 2011). Teacher survey statements were used to determine social validity.

Validity and Reliability

Inter-Observer Agreement (IOA)

To provide evidence that the measures of the dependent variable were accurate, a second observer independently scored data on a minimum of 30% of all sessions across each condition of the study at a level of at least 90% agreement (Kazdin, 2011). The observer was trained on the modeling of examples and non-examples of TTC trials using recorded performances (see Error! Reference source not found. and Appendix D) of persons not involved in the study who ere modeling complete and incomplete TTC trials using the protocols within Appendix A until at least 90% accuracy was reached on the occurrence of complete and incomplete three-term contingency trials on one 5-minute interval of observations.

Once the secondary observer was trained, agreement data were collected on the percentage of complete/incomplete TTC trials during a minimum of 30% across all conditions of the study. An agreement was scored when both observers documented either a completed TTC trial or an opportunity to complete a trial according to the criteria in Appendix A. Percentage of agreement was calculated using a point-by-point analysis of the recordings on the TTC Data Collection Sheet (Appendix C), dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100% (Gast, 2010). In order to control for observer drift, the investigator and the secondary observer met weekly for review (Cooper et al., 2007).

Treatment Integrity

A second trained observer conducted checks on the investigator's fidelity of coaching for at least 30% of each participant's sessions during each condition of the study using the Fidelity of Treatment Checklist (see Appendix B). The observer was trained on the modeling of examples and non-examples of TTC trials using recorded performances (see Appendices A and D) of persons not involved in the study modeling complete and incomplete TTC trails using the protocols within Appendix A until at least 90% accuracy was reached.

Validity of Instruments and Protocols

The protocols for data collection, baseline and intervention conditions, checking fidelity of treatment, and social validity (Appendices C, J, K, B, and G, respectively) were all designed and used by the researchers in the study conducted by Scheeler et al. (2012), during which immediate feedback on the use of TTC trials was given to teachers via BIE during reading and mathematics instruction. The primary author, Scheeler, an expert in the area of immediate feedback via BIE for the completion of TTC trials, has provided the instruments. Slight adaptations have been made to the instruments, and the primary author conducted an expert review and determined the appropriateness of their use in this study.

Social Validity

In this study, the investigator attempted to evaluate Wolf's third dimension of social validity (1978), i.e., the social importance of the effects of behavioral treatment. In an attempt to assess the social validity for this investigation, participant interviews were conducted at the conclusion of the study. The survey (see Appendix G) comprises nine open-ended response items to ascertain the participants' feelings about the comfort levels they experienced during the wearing of the BIE device, perceived values of the study, distractibility on the part of the participants or their students by the BIE device, and questions regarding recommendations for other ways to use BIE.

CHAPTER FOUR: RESULTS

Chapter Overview

In this chapter the researcher reports the result of the data related to the potential effectiveness of providing virtual coaching to novice science educators to increase the percentage of completed TTC trials. Results are organized in terms of the three specific research questions proposed for this study. The researcher reports the outcomes of data gathered on each question: percentage of completed TTC trials, frequency of correct student responses, and maintenance of the intervention. The chapter concludes with an analysis of the perceptions of the study's social value by the teacher participants.

A single-subject multiple-baseline-across-participants design (Gast, 2010) was used to answer the following three research questions:

(1) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the percentage of completed TTC trials;

(2) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the rate of correct student answers; and

(3) Will the teachers maintain their newly learned behaviors when the intervention is removed?

Participants

The participants in this study included a convenient sample of three novice general education secondary science teachers from a large, suburban public school district. Criteria for participation in the study included (a) participants must be novice science teachers, and (b) participants must have at least one student identified as receiving services under the IDEA (1997) for EBD. None of the teachers had received any form of training in behavior management prior to the study. Teachers' names were changed for data reporting. The participants in the study were Eliza, Katherine and Tom.

Observations

Sixty-seven 15-minute observations were conducted online using Adobe® Connect™ and Bluetooth earpieces. These observations were analyzed and coded for the study over a six-week time period. The times during which the observations occurred ranged from 11:16 a.m. to 1:55 p.m. For each of the classrooms and teachers observed, during these time periods no other teachers or assistants were present. Because a multiple-baseline design was used, the teachers' numbers of overall sessions varied according to how much time they spent in the baseline condition (see Figure 12).

Inter-Observer Agreement

To provide evidence that the measures of the dependent variable were accurate, the investigator and a trained second observer independently scored 30% of all sessions across each condition of the study at a level of at least 90% agreement on a the point-by-point analysis, and no re-training of the observer was necessary. Table 6 provides data on the inter-observer agreement of analysis.

Table 6

Inter-Observer Agreement Across Phases

Teacher	Mean	Range
Eliza	98.0	96-100
Katherine	99.0	98-100
Tom	96.0	90-100

Procedural Fidelity of the Investigator

Procedural fidelity of the investigator's provision of virtual coaching was assessed across 30% of sessions across conditions of the study. The second observer ensured that the investigator provided virtual feedback according to the criteria in the *Protocol for Delivering Immediate Feedback* (Appendix I). During the fidelity checks, the second observer recorded the evaluations on the Fidelity of Treatment Checklist (Appendix B). Fidelity measured 100% across all participants during baseline and treatment conditions.

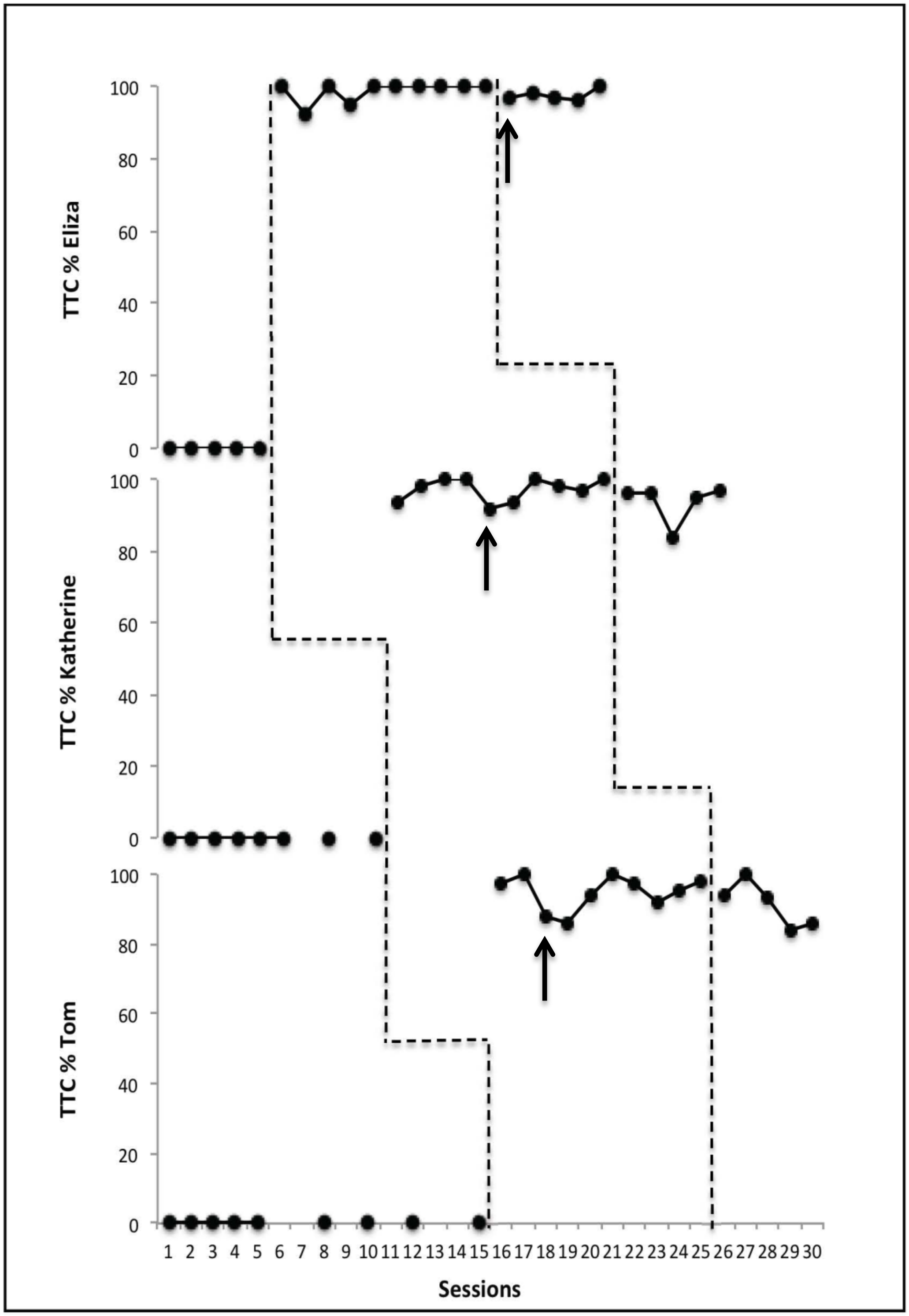
Data Analysis

Two types of data were collected and analyzed to address the three research questions. Tau-U analysis of non-overlap and trend of data was used to demonstrate effects of the treatment on the dependent variables (Parker et al., 2011) for questions one and two.

Research Question One

The dependent variable for question one was the percentage of completed TTC trials. A completed TTC trial was counted only if all three of the components occurred in succession (see Appendix A). The opportunity to complete a TTC trial was counted if the teacher presented the student with an opportunity to respond. Then, the percentage of completed TTC trials was calculated by dividing the total number of completed trials by the total number of opportunities to complete trials and results were calculated from the data collected on the TTC Data Collection Sheet (Appendix C).

A graph of the teachers' completion of TTC trials over the course of the investigation is presented in Figure 12. During the baseline condition, a zero-accelerating trend was consistent among all of the teacher participants; therefore the investigator randomly drew names to determine which teachers would enter into the treatment condition. Visual analysis of the data reflected that all three teachers demonstrated an increase in percentage of completed TTC trials upon receiving treatment. The teachers achieved maintenance of the intervention after the investigator removed the treatment. An analysis of each subject over the baseline, treatment, and maintenance phases is provided. There were two days where either statewide assessments took place or when a teacher's illness affected opportunities to conduct observations. Those occasions are denoted by an arrow in Figure 12.



Arrow indicates where observations resumed after teacher illness or administration of statewide testing.

Figure 12: Percentage of Completed TTC Trials Across Conditions.

Eliza

After five baseline sessions, Eliza had completed zero percent of the opportunities to complete TTC trials among her students. Eliza subsequently participated in a total of ten treatment sessions. As displayed in Figure 12, she obtained criterion during the first treatment session, scoring 100% on the TTC Data Collection Sheet (Appendix C). Eliza retained at least 92% proficiency throughout the treatment condition ($\bar{x}$ = 98.7%), and completed 100% of the TTC trials during the final six treatment sessions (see Table 7). When the treatment was removed, Eliza maintained the behavior of completing TTC trials with a mean percentage of 97.6%, and completed 100% of TTC trials during the final maintenance probe.

Katherine

Katherine received three probes after the five initial baseline sessions. After completing zero percent of TTC trials during the baseline condition, Katherine participated in a total of ten treatment sessions. As displayed in Figure 12, she scored at 94% after the first treatment session and Katherine remained at a minimum of 92% proficiency throughout the treatment condition ($\bar{x}$ = 97.9% - see Table 7). When the treatment was removed, Katherine maintained mastery of the behavior of completing TTC trials with a mean percentage of 93.6%, completing 97% of TTC trials during the final maintenance probe.

Tom

Baseline conditions for Tom reflected zero percent on the dependent variable of research question one. Tom received four probes after the five initial baseline sessions. He then received the intervention of virtual coaching on the completion of TTC trials over a total of ten treatment sessions. As displayed in Figure 12, he scored at 97% after the first treatment and 100% on the second session. His percentage of completion dropped below the 90% criteria during sessions three and four, but he achieved criteria of at least 90% completion during the remaining six observations. Tom retained at least 86% proficiency throughout the treatment condition ($\bar{x}$ = 94.7% - see Table 7). When the treatment was removed, Tom maintained mastery of the behavior of completing TTC trials with a mean percentage of 91.4%. However, he completed only 86% of TTC trials during the final maintenance probe.

Table 7

Mean Percentages of Completed TTC Trials Across Conditions

Teacher	Baseline	Intervention	Maintenance
Eliza	0% (0%- 0%) 5 Sessions	98.7% (92%-100%) 10 Sessions	97.6% (96%- 100 %) 5 Sessions
Katherine	0% (0%-0%) 8 Sessions	97.9% (92%- 100%) 10 Sessions	93.6% (84%-97%) 5 Sessions
Tom	0% (0%-0%) 9 Sessions	94.7% (86%- 100%) 10 Sessions	91.4% (84%- 100%) 5 Sessions

Summary for Research Question One

The researcher proposed the second research question to determine the effect of providing covert virtual coaching via BIE on the percentage of TTC trials completed by middle school science teachers. The only variable that changed between baseline and treatment conditions was the provision of coaching with feedback. None of the sessions within the study were cancelled due to interruptions. A positive change in trend direction was noted for each of the three teachers when moving from baseline to treatment conditions, and change was observed to be directly relative to the coaching intervention. An analysis of change across similar conditions indicated that across participants, baseline levels were maintained until virtual coaching with immediate feedback was introduced, causing accelerating levels in each of the participants' data. Participants' percentage of completed TTC trials improved the first session after the coaching intervention was introduced. Across participants, the overall mean gain from baseline phase (0%) to intervention phase (97.1%) was 66%. All participants successfully met criteria for termination of intervention (i.e., 90% mastery for three data points in a row) and maintained the teaching behavior after the intervention was removed on an average of 94.2% proficiency.

Corrective feedback from the researcher in the form of prompting teachers toward completing TTC trials varied. Prompting of the teachers to complete the TTC trials was dependent on the degree of support needed by each teacher to satisfy the criteria of complete TTC trials shown in Appendices A and D. Table 8 displays the rate of researcher feedback given to teachers per each 15-minute treatment session.

Table 8

Mean Rate of Researcher Feedback to Teachers Per Treatment Session

Teacher	Treatment Session	Feedback from Researcher	
		Correction	Praise
Eliza	1	8	31
	2	5	35
	3	2	27
	4	1	37
	5	4	45
	6	0	33
	7	4	45
	8	4	37
	9	5	40
	10	5	40
Katherine	1	2	18
	2	2	40
	3	3	44
	4	2	27
	5	5	36
	6	1	32
	7	3	37
	8	3	41
	9	2	28
	10	0	35
Tom	1	10	62
	2	16	92
	3	15	46
	4	8	38
	5	9	60
	6	9	36
	7	11	62
	8	5	70
	9	6	74
	10	6	80

Combination of non-overlap and trend data were calculated using a Tau-U analysis of effect size using the Tau-U Calculator (Vannest et al., 2011). Scaling of effect size for Tau-U follows the same conventions as Cohen’s d for regression and correlation analyses (Cohen & Cohen, 1983).

Treatment condition results reflect a Tau value of 1 for each teacher, indicating that the intervention had a large effect. Table 9 presents the results of the Tau-U analysis for research question one.

Table 9

Tau-U Analysis Results for Research Question One

id	Label	S	PAIRS	TAU	TAUb	VARs	SD	SDtau	Z	P Value	CI 85%	CI 90%
trend:												
0	P1BL vs P1BL	0	10	0	0	16.6667	4.0825	0.4082	0	1	-0.588<>0.588	-0.672<>0.672
1	P2BL vs P2BL	0	10	0	0	16.6667	4.0825	0.4082	0	1	-0.588<>0.588	-0.672<>0.672
2	P3BL vs P3BL	0	10	0	0	16.6667	4.0825	0.4082	0	1	-0.588<>0.588	-0.672<>0.672
phase:												
4	P1BL vs P1IV	50	50	1	1	266.6667	16.3299	0.3266	3.0619	0.0022	0.530<>1.470	0.463<>1.537
5	P2BL vs P2IV	50	50	1	1	266.6667	16.3299	0.3266	3.0619	0.0022	0.530<>1.470	0.463<>1.537
6	P3BL vs P3IV	50	50	1	1	266.6667	16.3299	0.3266	3.0619	0.0022	0.530<>1.470	0.463<>1.537
corrected baseline:												
-	-	-	-	-	-	-	-	-	-	-	-	-
combined:												
-	-	-	-	-	-	-	-	-	-	-	-	-

Weighted Average

Label	Tau	Var-Tau	Z	P-Value	CI 85%	CI 90%	CI 95%
#3+#4+#5	1	0.1886	5.3033	0	0.7285<>1.2715	0.6898<>1.3102	0.6304<>1.3696

School-wide PBIS is a paradigm for proactive behavioral management in use in most schools today that recommends the use of praise as an intervention (Myers et al., 2011). The recommended ratios for delivery of praise statements in the literature range from three to four for every corrective statement (Alberto & Troutman, 2012; Myers et al., 2011) to six per 15-minute observation session (Sutherland, Wehby, & Copeland, 2000). A post hoc analysis of the data revealed that each teacher's ratio of praise to error correction increased from the baseline to the treatment condition, and aligned with the recommended ratios during treatment and maintenance conditions. Table 10 displays the ratios of each teacher's use of praise to error correction across each condition of the study.

Table 10

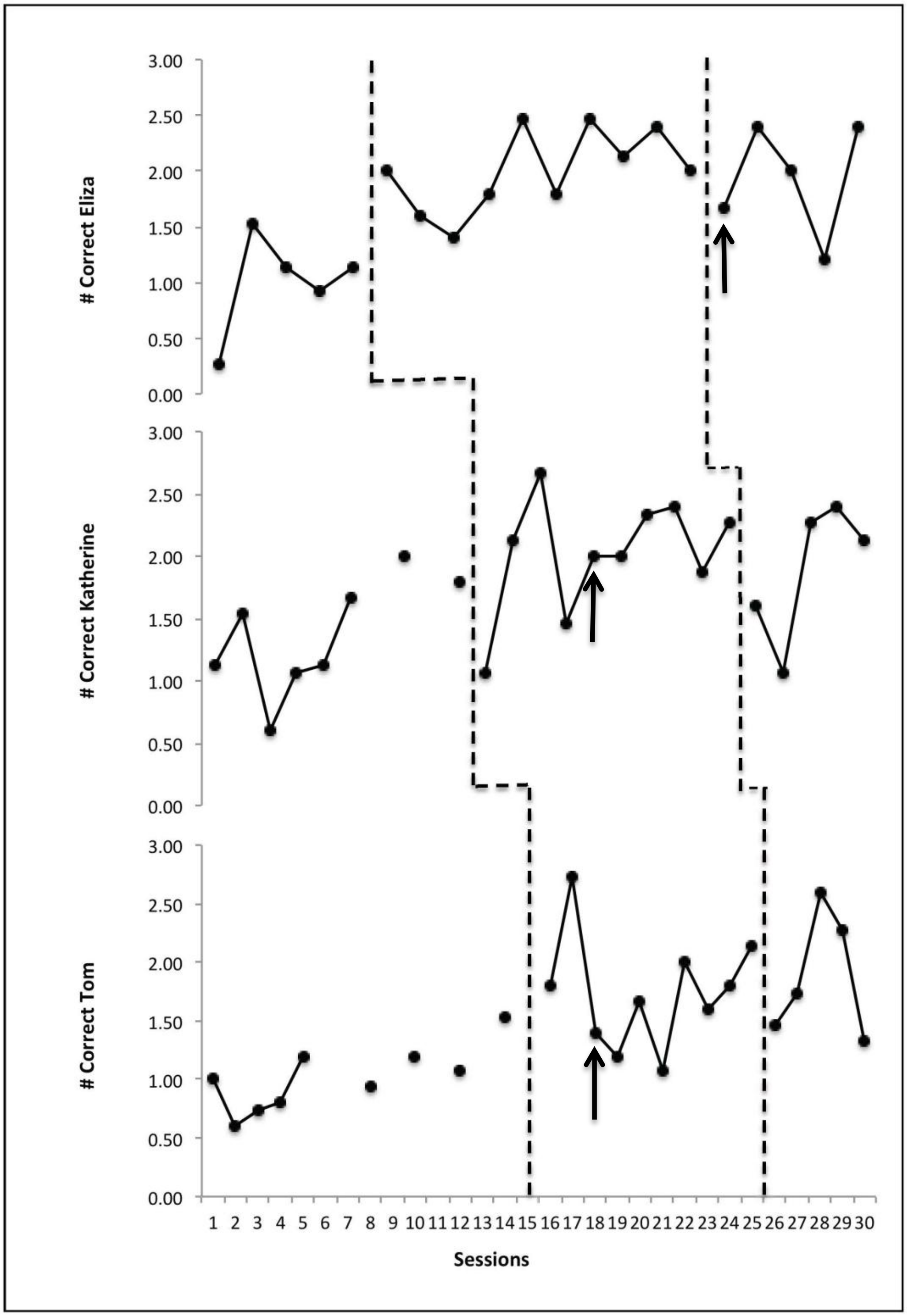
Ratios of Teachers' Use of Praise to Error Correction Across Conditions

Teacher	Phase	Ratio
	BL	0.2:1
Eliza	IV	4.1:1
	M	5.7:1
	BL	0.2:1
Katherine	IV	7.5:1
	M	9.9:1
	BL	0.1:1
Tom	IV	4.5:1
	M	7.4:1

Research Question Two

The dependent variable proposed by the researcher for the second research question was the rate of correct student responses when the teacher presented an antecedent. Correct student responses were both verbal and nonverbal. Examples of correct and incorrect verbal and nonverbal responses in the context of TTC trials are provided in Appendix A. The rate of correct student responses was measured using the TTC Data Collection Sheet (Appendix C). Correct responses were recorded for all students in the teachers' classrooms, including students labeled EBD. The student behaviors reflected in Table 5 were identified by the students' IEPs. Because none of the teachers had seen the IEPs of their students labeled EBD prior to the initiation of the study, the specific maladaptive behaviors identified in Table 5 were not targeted.

Opportunities for students to respond varied across sessions and study conditions, depending on the activities taking place in their classrooms. However, the level of correct student responses did increase in each of the teachers' classrooms when the teachers received the treatment of receiving immediate feedback via BIE. The intervention occurred during whole class instruction when students with EBD were included in general education science classrooms. Correct student responses reflect those given by all students within those conditions. Figure 13 displays the frequency of correct student responses per minute across conditions of the study. There were occasions day that either statewide assessments took place and when teacher illness affected opportunities to conduct observations. Such occasions are denoted by an arrow in Figure 13.



Arrow indicates where observations resumed after teacher illness or administration of statewide testing.

Figure 13: Frequency of Correct Student Responses Per Minute Across Conditions

Eliza

During the first baseline session, Eliza's students correctly responded to antecedents at a rate of 0.27 per minute, averaging a rate of 1.00 per minute throughout the baseline condition. Eliza subsequently participated in a total of ten treatment sessions. During the treatment condition, the mean rate of correct student responses to Eliza's antecedents increased to 2.01 per minute. When the treatment was removed, Eliza's students correctly responded to her prompts at a mean rate of 1.93 per minute. Table 11 displays the mean rate per minute of correct student responses to teacher prompts across teachers and conditions.

Katherine

During the first baseline session, Katherine's students correctly responded to antecedents at a rate of 0.60 per minute, averaging a rate of 1.37 per minute throughout the baseline condition. Katherine subsequently participated in a total of ten treatment sessions. During the treatment condition, the mean rate of correct student responses to Katherine's antecedents increased to 2.02 per minute. When the treatment was removed, Katherine's students correctly responded to her prompts at a mean rate of 1.89 per minute. Table 11 displays the mean rate per minute of correct student responses to teacher prompts across teachers and conditions.

Tom

During the first baseline session, Tom's students correctly responded to antecedents at a rate of 0.60 per minute, averaging a rate of 1.01 per minute throughout the baseline condition. Tom subsequently participated in a total of ten treatment sessions. During the treatment condition, the mean rate of correct student responses to Tom's antecedents increased to 1.74 per minute. When the treatment was removed, Tom's students correctly responded to his prompts at a mean rate of 1.88 per minute. Table 11 displays the mean rate per minute of correct student responses to teacher prompts across teachers and conditions.

Table 11

Mean Rate Per Minute of Correct Student Responses Across Teachers and Conditions

Teacher	Baseline	Intervention	Maintenance
Eliza	1 (0.27-1.53) 5 Sessions	2.01 (1.40-2.46) 10 Sessions	1.93 (1.20-2.40) 5 Sessions
Katherine	1.37 (0.60-2.00) 8 Sessions	2.02 (1.07-2.67) 10 Sessions	1.89 (1.07-2.40) 5 Sessions
Tom	1.01 (0.60- 1.53) 9 Sessions	1.74 (1.07- 2.73) 10 Sessions	1.88 (1.33- 2.60) 5 Sessions
Average across participants	1.23 (0.27—2.00) 22 Total Sessions	1.92 (1.07-2.73) 30 Total Sessions	1.90 (1.07- 2.60) 15 Total Sessions

Summary for Research Question Two

The investigator's objective for analyzing the data of this research question was to determine the effect that providing covert virtual coaching via BIE had on the frequency of correct student responses to antecedents provided by the teacher. The only variable that changed between baseline and treatment conditions was the provision of virtual coaching via BIE to the teachers with immediate feedback. A positive change in trend direction was noted across each teacher's students when moving from baseline to treatment conditions, and change was observed to be directly relative to the coaching intervention. An analysis of change across similar conditions indicated that for each teacher, mean rates of correct student responses were lower during baseline levels until virtual coaching with immediate feedback was introduced, causing accelerating levels in each of the participant's student data. Across participants, the overall mean gain from baseline phase (1.23 correct student responses per minute) to intervention phase (1.92 correct student responses per minute) was 0.69. The students' average rate of correct responses to teacher antecedents was 1.90 per minute.

Combination of nonoverlap and trend of the second dependent variable was calculated using a Tau-U analysis of effect size using the Tau-U Calculator (Vannest et al., 2011). A calculation of phase contrasts of baseline and intervention conditions is displayed in Table 12. Results show a Tau-U score of 0.96 for measuring the rate of correct responses among Eliza's students, indicating a large treatment effect. Results for Katherine's students reflect a Tau-U score of 0.69, also indicating a large treatment effect. Similarly, results for Tim's students also indicate a large treatment effect, by a Tau-U score of 0.86.

Table 12

Tau-U Analysis Results for Research Question Two

id	Label	S	PAIRS	TAU	TAUb	VARs	SD	SDtau	Z	P Value	CI 85%	CI 90%
trend:												
0	P1BL vs P1BL	1	10	0.1	0.1053	16.6667	4.0825	0.4082	0.2449	0.8065	-0.488<>0.688	-0.572<>0.772
1	P2BL vs P2BL	15	28	0.5357	0.5455	65.3333	8.0829	0.2887	1.8558	0.0635	0.120<>0.951	0.061<>1.011
2	P3BL vs P3BL	21	36	0.5833	0.5915	92	9.5917	0.2664	2.1894	0.0286	0.200<>0.967	0.145<>1.022
phase:												
3	P1BL vs P1IV	48	50	0.96	0.96	266.6667	16.3299	0.3266	2.9394	0.0033	0.490<>1.430	0.423<>1.497
4	P2BL vs P2IV	55	80	0.6875	0.7006	506.6667	22.5093	0.2814	2.4434	0.0145	0.282<>1.093	0.225<>1.150
5	P3BL vs P3IV	77	90	0.8556	0.8701	600	24.4949	0.2722	3.1435	0.0017	0.464<>1.247	0.408<>1.303
corrected baseline:												
-	-	-	-	-	-	-	-	-	-	-	-	-
combined:												
-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted Average												
Label	Tau	Var-Tau	Z	P-Value	CI 85%	CI 90%	CI 95%					
#3+#4+#5	0.8286	0.1699	4.8759	0	0.5839<>1.0733	0.5490<>1.1081	0.4955<>1.1617					

In an effort to determine the social value of the study (Horner et al., 2005; Wolf, 1978), the investigator distributed a survey to each participant via email at the conclusion of each treatment session. The social validity survey (Appendix G) includes nine open-ended items. The items inquired into the teachers' perceptions of using BIE during the study, their recommendations for future uses of BIE, and the effects of the intervention on their students.

Teacher Perceptions About Using BIE

Results of the survey reflect that all three of the participants had positive perceptions about receiving feedback via BIE during the study. According to Eliza, "I enjoyed it because the feedback was quick and related to what was occurring in my class at that moment. The feedback was between the researcher and myself." Katherine was uncertain about receiving feedback initially, but said that once she got used to wearing the earpiece, it became part of the routine. "When the study was over, I actually missed having the feedback that I came to rely on," she stated. On the note of quality of feedback, Tom stated, "It was very relevant and helpful during times that could have gotten out of hand if I didn't follow through with my students."

The teachers' responses on their perceptions of distractibility while receiving feedback varied. Tom stated that there were times when he could not hear the feedback clearly when his students were too loud. It is noteworthy that the camera on the iPhone that Tom used was distracting to his students. This distraction may have been due to the timing of when he set up the phone, which was as his students were entering the classroom. The use of his phone may have been less distracting if he had had the device in place prior to his students entering the classroom.

Katherine stated that she was only slightly distracted during the first session, but quickly got used to receiving feedback. Small delays in connectivity created confusion as well. For example, during a session in which Eliza was asking multiple students to be seated the investigator had given multiple feedback statements. The lapse in connectivity in addition to the classroom activity caused her to be confused. When reporting on the incident, she stated:

> There was a time I got feedback that I didn't understand or didn't fit to what was going on. Example: Praise the student for sitting down. The student wasn't sitting down yet. So I didn't respond when I received the feedback, I responded when the student did sit down.

When asked about how they felt about using webcams and Adobe® Connect™ throughout the study, the teachers each indicated varying degrees of adjustment to its use. Katherine stated, "Before this study I had not used Adobe® Connect™, but now that I have experience with it, the program was easy to use and easy to set up between classes in preparation for the observation/feedback." As he used his own phone, Tom had another perspective, "I had to log into the app between classes while my kids were coming in, so it was hard to get them to settle down once I was set up." Katherine added, "The kids caught on quickly and had questions. I had to remind them that I was learning how to be a better teacher."

Connectivity was lost while observing both Eliza and Tom. The incidences occurred with Tom during the 12th session and Eliza during session seven. However, reconnection took less than two minutes on each occasion. If the interruption lasted two minutes or more, the session would have been cancelled, as done by Wade (2010). Both teachers stated that the disconnection was inconvenient, but that they valued the ease of reconnection on Adobe® Connect™. Eliza stated, "I liked how easy the program was to use (user friendly)…. I think using the iPad was easy because the program and the webcam were right there." When connectivity was lost with Tom, "the app was already open on my phone, so I just logged back in."

Recommendations for Other Uses for BIE

The teachers did have recommendations for using BIE in ways other than how it was used in this study. According to Tom, "it would be a great tool to provide mentoring from other teachers at my school so we could follow up with each other during (professional learning community) meetings." Katherine simply wrote that BIE would be well suited for co-teaching. Eliza stated that she valued the discreet manner in which supervision and feedback were given. "My class was not disrupted from someone coming in or leaving… It was less threatening than administrative observations. I could be myself." She added, "For classroom management, new teachers and student teachers could really benefit from using this technology to receive the feedback they need to succeed without a person coming in and disrupting class."

Student Impact From Using BIE

When asked about whether the teachers noticed any impact on their students from their receiving immediate feedback via BIE, all of the teachers responded that they did notice positive changes in their student's behavior. "I have seen a HUGE improvement in behavior from my students. Students that wouldn't do any work have started producing (some) work, particularly in the case of (Steven). I've learned a lot from this experience and would definitely do it again! ☺" wrote Eliza. Katherine stated, "My students responded better when I was given cues. I was amazed at some of the results. It just goes to show how far praise and follow through can go."

Tom also mentioned the result of increasing the rate of praise with his students. "I did find that they (the students) responded better when they got praised for following directions and when I was more positive with them. I will definitely continue to use this strategy in the future."

Summary of Results

In summary, this chapter presented the results of the data analyses procedures, which included (a) visual analysis of graphically displayed data points; (b) Tau-U analysis of non-overlap and trend; (c) inter-observer agreement, and; (d) social validity survey reporting. Before receiving virtual feedback via BIE, novice general science educators who taught students with EBD among their nondisabled students were unable to complete any TTC trials. Analyses of the data reflected that when supported with immediate feedback via BIE, all three teachers improved their rates of providing opportunities to respond (OTR) and feedback in the form of either error correction or praise, and maintained their use of TTC once BIE coaching was removed. Further, the treatment had an effect on the teachers' students' behaviors, whose correct responses increased from baseline conditions.

Inter-observer agreement and treatment fidelity were examined in order to ensure reliability in measuring the dependent variables and quality of the feedback from the investigator. The reliability of the teaching behaviors observed in the completed components of TTC trials exceeded minimum levels of agreement across each condition, thereby supporting the integrity of the study. Fidelity of treatment was conducted across all phases using a validated instrument (Appendix B). Fidelity of treatment on the part of the investigator was 100% across conditions.

Prior to the study, all of the teachers reported a need for support in managing classroom behaviors. They each stated that using BIE as a means of providing instructional support during teaching was beneficial to them. All of the teachers reported enhanced abilities to manage classroom behaviors. Despite the fact that there were no occasions of hands-on science activities during the study, all of the teachers stated that they noticed changes in academic and social behaviors once they received feedback during the intervention.

CHAPTER FIVE: DISCUSSION

The need for new science teachers to receive support in classroom management is essential for the success of all students. This need is further pronounced for students who are labeled EBD and the teachers who provide them instruction in general education science courses. One way to potentially provide support to both students and new science teachers is through technology. Educational technology has advanced to the degree that novice teachers can receive discreet coaching related to behavior and even content support that is synchronous to their teaching (Rock, et al., 2011). A potential intervention for new science teachers working with students related to behavior, especially students who are EBD, is through Bug-in-the-Ear (BIE) technology. This tool was used to provide coaching in the evidence-based instruction of TTC trials to improve academic and behavioral outcomes for students and teachers alike in the science classroom. This study provided evidence that when novice science teachers were coached via BIE to complete TTC trials as they worked with students labeled EBD, the teachers mastered this evidenced-based practice and more importantly their students' academic performance improved. The investigator provides in this chapter a summary of this study followed by a direct tie to the literature in the field. The chapter concludes with discussing the implications and limitations of the current study.

Purpose of the Study

Students with EBD are characterized by an ability to achieve academically but often fail to demonstrate such acquisition of knowledge (Kauffman & Landrum, 2012; Wagner et al., 2004). Students with EBD have benefitted socially and academically from working with partners and from kinesthetic learning approaches that often are found in effective science classrooms (McCarthy, 2005, Gillies, 2008). However, the behaviors of students with EBD frequently present challenges to general educators, especially beginning teachers, in these activity-based classrooms. Early career general educators have expressed their unpreparedness to manage the inclusion of students with EBD into their classrooms (Jolivette et al., 2002), yet have also stated an eagerness to learn EBPs for behavior management (Garland et al., 2013). Exacerbating their lack of preparation is the fact that new teachers typically focus on decreasing maladaptive behaviors prior to focusing on effective instruction, thereby contributing to learning gaps for this population of students (Forness, 1981; Lane, 2004; Vannest et al., 2009). Such conditions often diminish the likelihood of students with EBD of not only being included, but of successfully staying in and passing the courses required for graduation (Scruggs et al., 1998).

When novice science teachers are prepared to manage difficult behaviors, it is they are more likely to remain in the field (Graham & Prigmore, 2009; Mastropieri & Scruggs, 1995). Further, when science teachers are well prepared in both content and classroom management, conditions are more felicitous to the academic success of students with EBD, whose likelihood of achievement has been shown to be greater in science than in other content areas (Gilles, 2008; Mastropieri et al., 2006). The investigator of this study examined the efficacy of providing novice teachers' virtual coaching in and utilization of three term contingency (TTC) trials for improving the behavior of students with EBD in general education science classrooms.

Summary of the Results

The intervention used in this study was targeted toward novice science teachers who taught in general education secondary classrooms that included students with EBD. Data were collected on teachers' percentage of completed TTC trials and on the academic behavior of correct student responses, as measured by correct responses per minute. Research questions for the study were:

(1) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the percentage of completed TTC trials;

(2) Will the intervention of providing immediate feedback delivered to novice science teachers via BIE affect the rate of correct student answers; and

(3) Will the teachers maintain their newly learned behaviors when the intervention is removed?

The investigator used a multiple baseline single subject design to examine the acquisition of an evidence-based teaching strategy (TTC trials) among novice science teachers during inclusive instruction of students with EBD. During the study, the investigator used BIE technology as a means of providing immediate feedback on the use of TTC trials. By implementing a multiple baseline method, the researcher focused primarily on identifying a valid, functional relationship between dependent and independent variables by replicating the results across participants.

The intervention affirmed research questions one and two. Upon implementation of the intervention, the teachers' completion of TTC trials increased (see Figure 12), and the correct answers from their students increased (see Figure 13). The structure of the TTC trial, when correctly implemented (see Appendix A), is designed to increase correct student responses. The increase in the presentation of OTR by the teachers had a direct relationship on the increase of the correct student responses. Similarly, the positive reinforcement to student responses in the form of praise or error correction also contributed to the increase in correct student responses. Praise given after correct student responses was positively reinforcing as noted in past research (Duchaine et al., 2011; Sutherland & Wehby, 2001), increasing the likelihood of future correct student responses. When students answered incorrectly, they were told the correct response and given another opportunity to provide the correct response. The relationship therefore was when teachers increased their completion of TTC trials, their students' correct responses increased accordingly.

The teachers in this study were able to meet mastery criteria (90% completion) in the use of TTC trials within five treatment sessions (see Figure 12). The intervention also had a strong effect on the number of correct responses from the respective teachers' students (see Figure 15). During direct virtual observations, the investigator used event recording to collect and visually analyze information gathered on the TTC Data Collection Sheet (Appendix C). Data for the first research question revealed an abrupt change in the level of percentage of completed TTC for all three teachers once the treatment was introduced (see Figure 12). Teachers' mean percentages of completion of TTC trials ranged from 94.7%-98.7% during the intervention (see Table 7). A Tau-U nonparametric analysis (Parker et al., 2011) of the data for research question one revealed that the intervention of providing immediate, virtual feedback to teachers on their completion of TTC trials had a very large treatment effect on the teachers' completion of trials (see Figure 13).

Data for the second research question revealed that frequencies of student responses per minute varied across conditions. However, once their teachers began receiving virtual coaching during the intervention condition, correct student responses increased in each teacher's classroom (see Figure 14). Tau-U analysis results indicated that the effect (see Figure 15) of the treatment on correct student responses in each of the teacher's classrooms was large. When the treatment condition concluded, the teachers were observed while teaching. Each of the three teachers maintained their newly acquired skill set once the treatment of immediate feedback was removed, as evident in Figure 14.

Each of the teachers revealed that receiving immediate feedback via BIE was a useful way to learn a new EBP teaching strategy. The teachers also reported being less distracted by BIE feedback than when other adults were physically present in their classrooms. They each indicated that given the opportunity, they would participate in another study that involved using BIE technology.

Connection to the Literature and Researcher's Insights

This study contributes to the existing literature base on virtual coaching of novice educators in the completion of TTC trials. The study conducted is unique in nature because teacher participants were all novice secondary science educators. The study is further enhanced in that among the students identified as having an EBD, all were included in their general education classrooms with no direct special education supports. Results of the current study are consistent with similar studies involving novice educators in other content areas and with different student populations in that once the intervention began, teachers' completion of TTC trials increased, using BIE. Correct student answers also increased. This study provided evidence that BIE and BYOD can help prepare novice science educators to use TTC trials to support the behavioral needs of students with EBD.

Within the review of literature, teaching skills that were documented as among the most critical in facilitating student achievement were: (a) increasing opportunities for student response (Haydon, Conroy et al., 2009; Sutherland & Wehby, 2001), (b) effectively using error correction procedures (Scheeler, 2008), (c) using specific, positive and corrective feedback (Scheeler et al., 2004), and (d) completing three-term contingency (TTC) trials (Albers & Greer, 1991). The TTC trial is based on the principles of applied behavioral analysis (ABA), a very structured approach to learning that focuses on skill acquisition and reinforcement of behaviors (Skinner, 1968). The acquisition of skill in completing TTC trials can be used with a wide range of ages and levels of student development (Albers & Greer, 1991), and has been taught to teachers during classroom instruction (Scheeler et al., 2004). However, the review of literature undertaken for this study resulted in a feebleness of research on teaching the use of evidence-based instructional practices in the preparation of novice general science educators when including students with EBD in their classrooms. The literature was even sparser when adding the element of virtual coaching.

Evidence from this study was directly tied to the themes identified in the literature for new science teachers who are supporting students with EBD in the general education setting. The researcher identified the following themes from that literature directly related to the procedures and outcomes of this research. These areas are discussed in the context of past findings and current outcomes of the study. Themes include (a) the history and legislation that have promoted the inclusion of students with EBD in the general education settings; (b) the characteristics of students with EBD that affect their inclusion in general education settings; (d) the preparation of novice general educators to teach students with EBD; and (e) the use of EBP among teachers who work with students with EBD. The results elicit support for providing immediate feedback to novice teachers during instruction improve their teaching techniques.

Implications and Relationship of the Current Study to Previous Research

Eugenics, compulsory attendance laws, and institutionalization are all indicators of treatment climate with regard to the early history of children with psychologically based disabilities (Richardson, 1999). Early conditions for children with mental disorders ranged from negligent to brutal (Blatt et al., 1966; Osgood, 2008; Wallin, 1922). Over time, legislation improved the way that children and youth with mental disorders received educational services. Concurrently, technological advances have contributed to improving the quality of teacher education and teacher effectiveness (Scheeler, 2008).

The language of IDEA (1997) gave provisions for students with EBD to be educated in the least restrictive environment (LRE). Interpretations and adherence to laws that require the education of students with EBD to receive education in the least restrictive settings are implemented subjectively. Although self-contained classrooms may have been eliminated in some schools, such as those in this study, students labeled EBD are still excluded more than those with other disability labels and may not receive services that are commensurate to their peers. The premise of this study was that students with EBD could learn successfully in general education classrooms if their teachers were prepared to effectively use evidence-based teaching strategies that addressed their learning and behavioral needs. Yet, unless actions are taken to provide general educators with evidence-based strategies to serve students with EBD in general education settings, where this population of students will be served will continue to be unclear.

The LRE may be compromised when teachers do not have the knowledge or skill to provide appropriate services for students with EBD, not necessarily because the nature or severity of the student's disability prohibits learning in the more inclusive setting. Although students with EBD in the current study were being educated among their nondisabled peers, their general education teachers were unaware of the descriptions of their disabilities, their accommodations, or their short-term goals and objectives. The degree to which students are served in LRE can be subjectively interpreted, and dependent upon the prevailing conditions existing at any given time.

When school leaders and teachers are unaware of or unskilled in implementing best practices on behalf of students with disabilities, the LRE can be compromised. The novice science teachers in this study overcame that compromising variable by learning how to use a research-supported teaching strategy effectively with students labeled EBD. Therefore in this study, the LRE was not affected by the lack of the teachers' preparation to ameliorate their students' disabilities so that they could achieve academic and behavioral success in the general education science classroom.

The dichotomy of general versus special education placements for students in p-12 classrooms are directly tied to preparation of general education teachers. If general education teachers are prepared to only include a particular population of students in their classrooms, they are likely to relegate those students whom they are not prepared to teach into environments that may be more restrictive. That is, the restrictiveness of the setting may be implicitly and unintentionally affected by a teacher's inability or unpreparedness to use EBP to accommodate learners with challenging behaviors. The results of this study showed that when general education teachers of students with EBD implemented TTC trials with fidelity, their students labeled as EBD were able to participate successfully in their classrooms for 100% of the regular instructional period. The USDOE (2011) reported that only 55.9% of students with EBD typically spend 40% or more of their time in a general education classroom, a sharp contrast to the percentages for other areas of disability.

Novice teachers in this study did benefit from covert instruction on the use of TTC trials in order to prepare them to provide support for students with EBD in the LRE. Establishing a high quality inclusive learning environment could be easier for new teachers if they are comfortable in exercising best practices with fidelity. The nature of the disability of a student with EBD can be exacerbated when a teacher does not effectively use practices that are proven to work with such students. The intervention in this study allowed new science teachers to receive immediate feedback on their fidelity of using TTC trials. The intervention used in this study had a large effect, and teachers were able to receive the intervention synchronously as they taught students labeled EBD in general education settings.

Virtual coaching has the potential for changing the landscape of professional development and clinical supervision. The ability for novice teachers to receive immediate feedback while they teach enables them to stay with their students as they learn new skills to use in their classrooms. Through the assistance of immediate feedback from an expert, new teachers can correct ineffective teaching behaviors and reinforce best practices. The appeal of eliminating factors such as cost, preparation of alternative lessons, and unruly student behaviors that are often associated with hiring substitute teachers so novice teachers can attend off-site professional developments also adds value to virtual coaching. In this study, teachers attained mastery of an evidence-based practice in five treatment sessions- equivalent to one hour and fifteen minutes of instruction. The practice is still relatively new, but virtual coaching offers a potentially highly effective solution to preparing teachers to obtain new skills.

Characteristics of Students with EBD That Affect Their Inclusion in General Education Settings

The ecological circumstances that often accompany students with EBD can affect their inclusion into the LRE- the general education classrooms (Wagner et al., 2004). The intervention used herein provided opportunities for students with EBD to have positive interactions with their teachers in general education classrooms. Moreover, because of the intervention, the students in this study experienced an increased number of opportunities for success, as well as positive reinforcement for those successes by their classroom teacher.

When teachers know how to increase opportunities for success and positively reinforce successes, schools can be perceived as environments that are helpful to students from challenging backgrounds such as those who are typically labeled as EBD (Crowley, 1993; Sutherland et al., 2008). Schools can and should be a venue for providing opportunities to learn skills that will help them academically and socially. A number of evidence-based practices for managing classroom behaviors exist (Simonsen et al., 2008), but until this study, no direct research provided an intervention to novice science educators to manage behaviors of secondary students with EBD. The intervention used in this study was effective in interrupting the cycle of behavior problems that students with EBD typically have (Colvin, 2007) by creating opportunities for response and positive reinforcement, as noted by an increase in correct student responses per minute (see Figure 14).

Preparation of Novice General Educators to Teach Students With EBD

The researchers who publish on the role of teacher attitudes emphasize that teachers need to possess a willingness to connect with students on a personal level (Barr & Parrett, 1995). Students with EBD have stated that they want to know that teachers care about them on a personal level and want them to succeed (Barr & Parrett, 1995). Teachers have shared they are not prepared for managing the behaviors of students with EBD (Duchaine et al., 2011), yet once they are certified they receive minimal support (Brownell et al., 2005). In order to resolve the problems expressed by teachers and students alike, this study focused on delivering instruction to novice teachers on how to use an evidence-based teaching strategy (TTC trials) with fidelity.

The teaching strategy (TTC trials), involved the provision of teacher feedback to students when they responded to teacher prompts. The strategy has a strong evidence basis (Greer et al., 1989), but is not exclusive for use with students labeled EBD. By providing positive reinforcement of student behaviors, teachers who use TTC trials among students with EBD build rapport and increased interactions with their students (Conroy, Haydon et al., 2009). The intervention in this study provided covert coaching in using TTC trials to novice teachers while they were actively teaching just as done during studies by Goodman et al. (2008) and Scheeler et al. (2012). Like those studies, when the novice teachers received the intervention, their percentages of completed TTC trials increased. The current study was unique from those studies in that the teachers in this study were all novice general educators who had students with EBD included in the classes where BIE coaching occurred.

The teacher population selected for this study consisted of novice science teachers because science is a content area in critical need of highly qualified teachers (NRC, 2012; NSTA, 2011). The teachers were selected for participation in this study because they taught students with the EBD label. The intervention was focused on this student population because students with EBD have the potential to be successful in science, but require behavioral reinforcement and a structured environment in order to achieve that success (Scruggs & Mastropieri, 2007).

Consistent with typical teacher development (Katz, 1972), the novice teachers in this study reported a lack of readiness to manage classroom behaviors effectively prior to receiving the intervention. Once they received coaching via BIE on TTC trials, the teachers increased their use of an evidence-based strategy for classroom management by 86%-100% (see Table 7). Teachers reported better interactions with their students as a result of the intervention in their social validity surveys taken at the conclusion of the study.

Implications of Technology on Managing Behaviors

Bug-in-the-Ear technology provided an opportunity for teachers in the study to immediately apply skills with their students. The acquisition of evidence-based strategies among teachers via BIE has been shown to be an effective means of increasing teachers' classroom management abilities and to have positive student impacts (Rock, Gregg, Thead, et al., 2009). The results of the current study are commensurate with previous findings in improving teacher and student learning (Rock, Gregg, Thead et al., 2009; Scheeler et al., 2012), yet are unique to novice science teachers working with students EBD in general education settings.

In the cases of each of the three novice science teachers, they all reported a lack of previous preparation in behavior management. Prior to the study none of the teachers knew exactly what it meant to be teaching a student with EBD or how to accommodate that student. This study provided an opportunity for novice science educators to learn to use an EBP for classroom management. When secondary science teachers who are new to the field can use EBPs with fidelity among students labeled as having an EBD, they are more likely to remain in the field and to have a positive impact on the postsecondary outcomes of their students. For the teachers and students in this study, virtual coaching had positive learning effects. Teachers were able to learn and maintain the use of TTC trials. Students had greater opportunities to respond, and when they did, the number of correct responses increased accordingly.

The results of this study imbue a paradigm shift in the way teachers are prepared by IHEs to manage their classrooms in a manner that establishes an environment conducive to the academic and behavioral success of all students. Providing novice educators with opportunities to learn in situ via BIE enables them to correct ineffective teaching strategies before they become integrated into teaching regimens and disparate to student progress (Heward, 1997). Virtual feedback given during instruction provides new teachers with opportunities to implement best practices immediately (Rock et al., 2011). Preparing general educators to use TTC trials with fidelity can empower them to effectively change the course of their students' success (Scheeler et al., 2012).

The Use of Evidence-Based Practices Among Teachers Who Work With Students With EBD

The intervention used in this study is an evidenced-based teaching practice (Albers & Greer, 2001) whose components themselves have a research basis for improving outcomes among students with EBD. By increasing opportunities to respond (OTR), researchers have shown that students with EBD increased their social engagement and number of correct responses (Sutherland & Wehby, 2001). The results of the study are consistent with those reported by previous studies in that when provided with increased OTR, students with EBD had higher levels of correct responses (Haydon, Conroy et al., 2009; Sutherland & Wehby, 2001).

Researchers have examined the integration of virtual coaching to assist novice teachers in implementing evidence-based practices in their classrooms (Rock, Gregg, Gable, et al., 2009; Scheeler & Lee, 2002). Scheeler and Lee (2002) reported that coaching in EBPs such as TTC trials via BIE should be considered essential in all teacher preparation programs. Bug-in-the-Ear technology can also be used directly with students to change their behavior. Scheeler and her colleagues (2008) examined the use of BIE with students by having peer tutors deliver immediate feedback to students with learning disabilities on their oral presentation skills. Similar support can be provided to students with EBD. Future applications of using BIE toward increasing inclusion rates among students with EBD include examining the effects of delivering coaching of self-monitoring strategies to students with EBD while they interact with their teachers and fellow students.

Another extension of using technology to prepare teachers could include examining the effect of providing coaching on the completion of TTC trials to novice educators while they practice their teaching skills in a mixed reality virtual classroom. Mixed reality classroom environments have been used to teach novice educators to acquire and master evidence-based teaching practices with high levels of fidelity in a fraction of the time that is typically required to do so (Vince Garland et al., 2012). Three-term contingency trials delivered to novice or student teachers via BIE while teaching in a mixed reality classroom could enhance the initial acquisition of the teaching strategy. Clinical supervision via BIE during student teaching could reinforce the practice in actual classrooms.

The review of literature revealed that the virtual coaching of novice special and general educators to complete TTC trials via BIE has been effectively implemented during reading, language, and math content (Goodman et al., 2008; Scheeler et al., 2009; Scheeler & Lee, 2002). In the current study, the intervention proved effective in increasing teachers' use of TTC trials and increasing correct student responses. Once the virtual coaching intervention was introduced, teachers' percentages of completed TTC trials increased from 0% to an average of over 90% within five sessions. The mean rate of correct student responses (Table 10) increased from as low as 0.27 per minute to as high as 2.73 per minute upon implementation of the intervention. Until this study, no exploration of implementing TTC trials (with or without BIE) had occurred with novice general science educators, or with students who have EBD.

Results further support the research conducted by Giebelhouse (1994), who stated that delivery of prompts via BIE could change ineffective teaching behaviors. Prior to the intervention of virtual coaching on TTC, all of the teachers struggled with classroom management. Figure 12 reflects that as a result of receiving prompts and feedback via BIE, all of the teachers in the study increased their completion of TTC trials. This study augments the literature in Table 2 by preparing novice science teachers who teach students with EBD by using BIE to deliver immediate feedback and adds dimension to the corpus of literature regarding virtual coaching provided in Table 3.

Data were collected on percentage of completed TTC trails in an attempt to extend the findings reported by Scheeler and her colleagues (2012), whose participating teachers taught reading and mathematics in general education settings. Results of the current study are commensurate to those found by Scheeler et al. (2006), who found that providing immediate, corrective feedback on the use of TTC trials to preservice teachers during their field experiences increased correct responses among students. The results imply that BIE in this study was an effective means of providing discrete, immediate feedback to early career science teachers so they can acquire in-situ learning of evidence-based strategies to support students with EBD. Further research is needed, but there is enough evidence from this study and past research by Scheeler and her colleagues (2012) to confidently report that when novice educators receive virtual coaching on TTC trials, a large effect on academic performance is apparent. Teacher preparation programming should include virtual coaching in the use of EBPs in actual classrooms as early as possible so novice teachers can provide greater opportunities for including students with EBD.

The current study was unique from previous study, as this was the first study that explored integrating a BYOD approach to resolving potential technological hurdles to coaching via BIE. Other studies have documented the use of teachers' classroom computers and otherwise consistent technological components of BIE across participants (Ploessl, 2012; Rock, Gregg, Howard et al., 2009). Due to the curricula and the classrooms in this study, it was necessary to improvise the means by which the investigator achieved audio and video correspondence with each participant. Based on available resources, Eliza used an iPad, Katherine used the combination of her classroom computer, a plug-in web camera, and a prepaid cell phone, and Tom used his iPhone. Although these factors limit the ability to identify potential benefits or shortcomings of the individual technologies themselves, the scenario offers promise to further investigation of using BYOD in research involving remote supervision.

Some lessons learned from the current BYOD study were realized related to cost, confidence, and ease of use. Although the video quality was superior within Katherine's classroom (see Figure 9), her BYOD configuration consisted of two separate devices (her classroom computer and the prepaid phone). The fact that she had to log into the Adobe Connect platform from her classroom computer to establish a video connection in addition to establishing an audio connection from the prepaid phone rendered that particular BYOD setup as the least efficient of the three. It is interesting to note that of all of the BYOD configurations, Katherine's was the least expensive. The cost of the Live! Cam Optia Pro web camera was about $80, and the cost of the prepaid phone with one month of service was $65. By comparison, the cost of an iPhone 5 was $200- $400, depending on memory capacity, and the cost of an iPad2 ranged from $400 to over $500.

Of all of the teacher participants, Eliza was the most efficient at setting up her device (the iPad2) and reestablishing connectivity when it was lost. All three of the teachers were able to reestablish connection with the investigator within two minutes when there was an interruption in connectivity. Therefore, a determinant of efficiency of the BYOD implementation was the user as well as the device related to ease of use. For example, the iPad2 that Eliza used was in a cover equipped with a stand that served as a consistent and stable means of supporting the position of the camera. Tom did not have such a cover with a stand. Prior to every observation session, Tom had to balance the iPhone in the same location on a shelf behind his desk. Had Tom's iPhone been in a holder with a built in stand similar to that of the iPad, setup might have been easier for Tom and less distracting to his students. Overall, the BYOD ease of use, confidence of the user, and the cost comparison were not a formal research question, but because the same results occurred with each device, this new aspect of BIE technology is one for future formal research and an expansion of past findings.

As technologies change and become increasingly mobile, the likelihood that using the BYOD approach to conducting research with BIE increases as well. Researchers considering embarking on having participants use a BYOD model should consider including the costs of the Internet plans and necessary bandwidths into their research proposal. The Adobe® website (2013) suggests 512 kilobits per second (Kbps). Another consideration for researchers who contemplate a BYOD model is to accommodate teachers in using their own devices. In his statement of how researchers could improve the way BIE is used in future studies, Tom suggested providing a stand for holding digital devices in a consistent location for observations, "I had limited time to get ready when we met, and this would have really helped".

Results were consistent in that the intervention increased percentages of completed TTC trials and correct student responses for all three of the teachers as well as their students no matter the device used. This study differed from the study conducted by Scheeler et al. (2012) in that it did not compare the effects of immediate feedback to delayed feedback. Scheeler and her colleagues (2012) provided delayed feedback to their participants in the form of a five-minute conference after the teaching session concluded. Had this been done, the percentages of completed TTC trials during the baseline condition would have likely been higher than 0% completed by each participant. However, the focus of this study was not to compare the effects of delayed versus immediate feedback. The literature review revealed that immediate feedback had greater effect in acquisition of teaching skills (Scheeler & Lee, 2002). In this study, immediate feedback from the investigator provided the teachers with the ability to tailor their behavior the moment that it was necessary to make a change.

A secondary measure investigated whether students with EBD increased their frequency of correctly responding to teacher prompts because their teachers received virtual coaching in completing TTC trials. The intervention effectively increased the teachers' percentages of completed TTC trials. The implications of this study conclude that by increasing completion of

TTC trials, new general science educators have a greater likelihood of being able to teach students with EBD when they are included in their classrooms.

Similarities to the study that Greer et al. conducted in 1989 also exist. Their study demonstrated a correlation between the number of trials students with disabilities received and academic success (Greer et al., 1989). The study reported herein extends the studies conducted previously, showing that when teachers increase their rates of completed TTC, correct student responses increase, and student behavior improves (Albers & Greer, 1991; Ferkis et al., 1997).

By preparing science teachers to complete TTC trials, teacher preparation programs can potentially increase inclusion rates of students with EBD into general science settings and improve postsecondary outcomes of students. Further, such preparation provides a quantifiable measure of teacher quality and student impact. When the general education teachers in this study were virtually coached to use TTC trials with high levels of fidelity, the level of completed trials rose visibly, as did in the study conducted by Scheeler and her colleagues (2012), their students' number of correct responses also increased.

Professional development on the using BIE in the coaching of TTC trials among teachers and administrators could be aimed at improving the way that teacher evaluations and observations could be conducted. Administrators could be taught how to use BIE technology to coach teachers to use EBPs such as TTC trials with fidelity, and remotely supervise teachers and provide immediate formative feedback during instruction. Teaching new science educators to use evidence-based strategies could enable them to broaden the range of students they can effectively teach, including students labeled EBD (Simonsen et al., 2008).

Researchers have identified qualities that facilitate the success of educators who teach students with EBD (Barr & Parrett, 1995). The use of error correction and praise not only serve to reinforce student behaviors (Haydon, Conroy et al., 2009), but also allows the teacher to acknowledge the strengths of her or his students. Students with EBD have stated that they value when a teacher demonstrates an interest in their success (Parsons et al., 2001). The results of the current study support the findings of Albers and Greer (1991) in that the number of correct student responses increased once their teachers received the intervention (see Figure 14). Further, the current research reinforces teaching behaviors found in other studies that have reported the impact of providing students with EBD increased OTR and reinforcing correct responses with praise (Duchaine et al., 2011).

The technology used in this study made it possible for the participating general education teachers to receive discrete, immediate feedback during whole class instruction when students labeled EBD were included. There would not have been opportunities for teachers to receive immediate feedback without BIE. As Katherine reported, students were aware of the presence and use of cameras in the study. For this reason, it is fair to surmise that the presence of a researcher would have been much more distracting to the students and that the likelihood of similar results in such a situation would have been reduced.

Limitations

Although the results of this study provide evidence that the intervention of providing virtual coaching to novice general science educators who taught students with EBD increased their use of TTC trials and increased correct student responses, the results of this study are not without limitation. Procedural and participant factors inherently affected the generalizability of the results of the study.

Procedural Limitations

Although the results herein reflect that the intervention affirmed the research questions, the study was not without limitations. For example, the purposive sampling method used in this study typically captures one or more specific predefined groups (Heinman, 2000), there are noted limitations with this type of sampling. Since purposive sampling is a deliberate effort to obtain representative samples by including subgroups within the population (e.g., novice science educators who teach students with EBD in a large suburban school district), the probability exists that those who participated in the study may be different from the actual population, introducing a potential of source bias (Heinman, 2000).

In addition, single subject design research methodology carries with it specific threats to validity. For example, threats to internal validity include circumstances related to prolonged baselines such as boredom. The small sample size inherent in single subject research studies that limits the external validity of the investigation (Kazdin, 2011).

In reporting on data collection procedures for single subject studies, Gast (2010) stated that baseline conditions should be measured over a minimum of three consecutive days. Due to the participants' individual schedules, and other scheduled weekly school activities, this standard was not possible. Instead, teachers and the investigator met every other day.

Because of the small sample size and purposive sampling used in this study, generalizability of results of single subject studies is limited to the participating novice science teachers only (Cooper et al., 2007; Gast, 2010; Horner et al., 2005; Kazdin, 2011). Another limitation is that the mere virtual presence of the investigator (i.e., the teachers knew they were being observed) may have influenced the behavior of the participants rather than the intervention of immediate feedback, thereby limiting the results. The willingness of the teacher participants to complete the social validity survey honestly and thoroughly at the conclusion of the study may have limited the results of the survey in terms of social value (Wolf, 1978).

Due to the parameters of time, there were other limitations that prevailed during the study. The study took place over a six-week period, which accordingly presented a small window of opportunity for data collection. There were three times that observations needed to be rescheduled for a variety of reasons, including illness of participants and administration of statewide assessments (see Figures 12 and 13). Additionally, there was limited time to wait between treatment removal and maintenance probes.

Participant Limitations

For various reasons, the teachers had not seen their students' IEPs until the study began. In fact, none of them knew for certain that they taught students who had EBD until they were contacted by the investigator to participate in the study. Therefore, behaviors identified within the students' IEPs could not be targeted a priori for measurement of change due to the intervention. The only reporting of student behaviors other than the frequency of correct responses were those from the social validity survey (see Appendix L). In the future, researchers who seek to measure changes in behaviors identified by student IEPs should ensure that teachers have student information prior to beginning their studies.

Participant history also needs to be considered a threat to the reliability of results. Based on their previous life experiences, teachers may have required more frequent prompting and coaching in order to ensure acquisition and maintenance of newly learned skills. This may have been dependent on their own perceptions of their students, their perceptions of their own abilities to manage behaviors, student demographics, or other factors. For example, Eliza had more teaching experience than did Katherine and Tom (both of whom were in their first year of teaching). Therefore, the ease with which Eliza adjusted to the intervention may have been different than that experienced by Katherine or Tom.

Concerning teacher performance during the intervention condition, the presence of the Hawthorne Effect may be considered. Once the participants knew what the intervention was, they did not need to receive as many prompts to initiate trials as they did to complete trials. Therefore, determining the effectiveness of providing immediate feedback via BIE is limited.

Another limitation in the study was the lack of consistency over BIE technology components among the teachers. Each teacher used a different type of device for a web camera and means of Internet access. Therefore, the ability to control for technical elements such as video resolution and Internet connectivity was limited. As Tom mentioned in his social validity survey responses, he had a challenge in setting up his BIE technology. He suggested that researchers provide teachers with some kind of stand on which their devices could be mounted in order to streamline setup for observations. Consistency across participants should be controlled as much as possible in any future research study. In a single subject study, conditions should be as similar as possible to ensure interpretability of results.

One of the limitations of using direct observational recording systems lies with the ability of the investigator to record accurately data while simultaneously watching and listening for behaviors (Gast, 2010). Although fidelity checks of the investigator met criteria, the flow of "behavior stream" (Gast, 2010, p. 140) was very rapid at times. Such an occurrences may have affected accuracy of data recording. Additionally, visibility was also limited during times which teachers dimmed the classroom lights to project recorded lessons, creating difficulty in determining whether students responded nonverbally to teacher prompts and potentially affecting accuracy of data collection. Due to the element of self-reporting, the teachers' responses to the social validity instrument used in the study may also have limited research findings. Finally, the precipitating factors for the behavioral manifestations of students with EBD are largely ecological (Kauffman & Landrum, 2012; Wagner et al., 2004), and therefore can present limiting factors to determining the effectiveness of any intervention.

Considerations for Researchers and Practitioners

Continued research in the area of virtual coaching of novice science educators could range in supporting teachers in giving instructions during laboratory activities and experiments to an endless list of other target teacher or student behaviors. For example during this study, the investigator never observed the teachers engaging students with hands-on or project-based science activities. This fact may have been purely circumstantial, but it is more likely that the novice science educators lacked either the organizational experience or managerial skills to conduct such activities. A future study could promote both behavioral and academic coaching using BIE for novice science teachers. With the adoption of the Next Generation Science Standards and the Common Core State Standards both encouraging richer dialogue and discussion in science instruction and project-based science instruction has strong support as a practice (NRC, 2012; NSTA, 2011), blending coaching of TTC trials with coaching in project-based procedures and practices could be a further expansion of this work to date with novice science teachers.

While students with EBD can be successful in science, they may need explicit instruction at times when laboratory safety takes precedence. If novice science educators are sufficiently prepared to manage classroom behaviors, they can focus their skills on delivering the rich, kinesthetic curriculum that is known to be particularly engaging to their students. Virtual coaching from an expert can assist novice general science educators in providing explicit, consistent instruction and immediate positive or corrective feedback to their students during highly structured activities.

In the current study, each of the teachers had only one student with EBD in their classrooms. However, the climate and culture of the classrooms varied greatly from school to school. Interaction effects may have created challenges due to such factors as school and student demographics that impacted the acquisition of targeted skills. For example, Tom taught at a school in which 79% of the students received free or reduced lunch, whereas the school at which Katherine taught had 42% of students receiving free and reduced lunch. Such a variance in socioeconomic status may have affected the manageability of students (Wagner et al., 2004). In order to more closely control for demography, future studies could be conducted with science content teachers in schools with similar socio-economic conditions. In addition, future studies involving the coaching of students with EBD should include an examination of the students' IEP prior to the onset of data collection so those behaviors could be measured across conditions to determine whether the intervention had any measurable behavioral effect.

Novice teachers in challenging environments could benefit from the guidance and feedback from an expert during virtual coaching without the addition of the distraction of having another person in the classroom (Scheeler et al., 2012). Social validity survey results from this study reflect that the participating teachers valued that they were able to receive expert feedback while they taught without the distraction of having another person in their classroom. Future studies could consider training mentor teachers to use BIE to provide feedback and professional development to their colleagues from a classroom in the same school. By doing so, novice practitioners could be supported more consistently throughout the school year by their colleagues.

The majority of the teachers of students with EBD have not received sufficient preparation to improve the educational or postsecondary outcomes for their students (Brownell et al., 2005; Rosenberg et al., 2004; Vannest et al., 2009). Virtual coaching via BIE in future studies could examine the education of novice teachers in the use of teaching behaviors that are known to be helpful in the education of students with EBD. Purposeful instruction in interpersonal strategies could therefore have the potential to prepare novice educators to establish meaningful rapport with all of their students- especially their students with EBD in inclusive classroom settings.

Technology has delivered the field of teacher preparation to a place where novice educators can receive immediate feedback from an expert as they learn to use EPBs while they teach (Scheeler & Lee, 2002; Rock et al., 2011). The current study was successful partly because the EBP taught was very specific with three components that had to be addressed in order to effectively implement the practice. Clear protocols were developed to describing examples and non-examples (see Appendix A) of each of the three components as well as video demonstrations of those examples and non-examples (see Appendix D). Expanding these components or combing coaching in TTC trial completion with other targeted areas of novice teacher areas of need are logical next steps in this line of research.

In addition, the scale of the current study could be increased by preparing administrators, clinical supervisors, or mentor teachers of novice educators to play the same role as the investigator within this study. To bring this study to a larger scale, observers could be prepared to fidelity using the same protocols. The observers would also need to receive support in using

BIE (see Appendix H) just like the teacher participants during the pre-baseline sessions. The lead observers could then checked on their fidelity of using BIE and delivering immediate feedback (see Appendix I) across all conditions (see appendices J and K, respectively) as well as their use of the TTC Data Collection Sheet (see Appendix C).

To date, studies have not been conducted aimed at improving the quality of teachers of students with EBD that utilize BIE or similar technology. Although this study focused on preparing novice science teachers to manage classroom behaviors when students labeled EBD were included, the intervention used is neither exclusive to novice science teachers nor students labeled EBD. Rather, completing TTC trials is a strategy that is appropriate for use by teachers of all students. As research has shown, novice teachers of all students have expressed a lack of readiness to manage classroom behaviors (Burden, 1982; Fuller & Brown, 1975; Garland et al., 2013; Katz, 1972). The teachers in this study were coached to use the strategy with fidelity while including students with the most challenging behaviors in their classrooms. If the novice teachers in this study could be prepared to use an evidence-based strategy for managing classroom behaviors with fidelity while including students labeled EBD in their classrooms, it certainly provides a rationale for all novice teachers to receive similar preparation during their clinical experiences, so they will have the confidence necessary to deliver challenging curricular content without the fear or lack of preparedness to manage classroom behaviors.

When teachers are able to manage behaviors confidently and consistently, their time can be better devoted to the task of teaching the curriculum and increasing student learning (Garland et al., 2013). Implications of this study are that when secondary students with EBD receive science instruction from a highly qualified teacher, they have opportunities to change the course of their postsecondary outcomes and potentially become globally competitive members of society. By giving novice general educators immediate feedback in using EBPs for managing difficult classroom behaviors, researchers could provide students with EBD a greater likelihood of truly receiving their educational services in the LRE, supporting novice teachers across the content areas, and most importantly potentially impacting student engagement and learning outcomes of this population of students.

APPENDIX A
EXAMPLES AND NON-EXAMPLES OF COMPLETE TTC TRIALS

Examples and Non-examples of TTC Trials*

The following are examples of correctly completed TTC trials targeted in this study and coached in the participants' classrooms during initial training before data collection occurs. A video recording will also be shown to the participants at that time.

1. Correct student response:

(A) Teacher: "What is the process by which plants make their own food?"

(B) Student: "Photosynthesis"

(C) Teacher: "That's right. Plants make their own food by photosynthesis."

2. Incorrect student response (consists of two separate TTC trials):

(A) Teacher: "What is the process by which plants make their own food?"

(B) Student: " Phototropism"

(C) Teacher: "No. The process is photosynthesis."

(End of 1st TTC trial)

(A) Teacher: "Try again. What is the process by which plants make their own food?"

(Start of next TTC trial.)

(B) Student: "Photosynthesis"

(C) Teacher: "Correct! The process is photosynthesis."

If the teacher presents an antecedent (A) to the student (i.e., opportunity to respond) and either the student responds correctly (B) but the teacher does not provide praise or the student responds incorrectly (B) and the teacher fails to correct the answer with the student who makes the error, it will not be counted as a completed TTC trial (Scheeler et al., 2012, p. 81)

The following are non-examples of TTC trials:

1. Correct student response:

(A) Teacher: “Are gametes formed during meiosis or mitosis?”

(B) Student: “Mitosis”

(C) Teacher: Says nothing in response to student’s answer and continues on to the next question, therefore, not completing the TTC trial.

2. Incorrect student response:

(A) Teacher: “Are gametes formed during meiosis or mitosis?”

(B) Student: “Meiosis”

(C) Teacher: “Who knows the answer?” (Non-example of a TTC trial because the teacher responds by asking another student to answer the question instead of correcting the error with the student who made it.

***Adapted from:** Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX B
FIDELITY OF TREATMENT CHECKLIST

Fidelity of Treatment Checklist: (30% of sessions)*

Name of Teacher: ________________________________

Name of Investigator: ________________________________

Date: ____________________

Time: Start:___________________to Stop:________________

Protocol	**Yes**	**No**	**Comments**
Teacher sets up technology and has access to feedback from investigator.			
Teacher wears BIE in on position.			
Investigator observes teacher for 15 minutes (minimum) to 20 minutes (maximum) per session.			
Investigator provides feedback to teacher within 3 seconds (corrective or praise statement) via BIE.			
Investigator gives **only immediate** feedback (no delayed and/or written feedback given on the dependent variable).			
Total number of steps completed in the protocol:			
Percentage of steps completed in the protocol:			

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education*, *35*(1), 77-90.

APPENDIX C
TTC DATA COLLECTION SHEET

TTC Data Collection Sheet*

Teacher: ____________________________ Session #: ____________________

Date: _______________________________ Content: _____________________

Time: _____________to_______________ Code: ________________________

Time (5-minute interval)	Antecedent (Teacher)	Response (Pupil)			Consequence (Teacher)	Feedback (Investigator)		
		Correct	Incorrect	None	Correction	Praise	Corrective	Praise

✓ = Behavior observed

# of opportunities to deliver TTC trials_______ #of TTC trials delivered_______

% of TTC trials delivered_________

***Adapted from:**

Scheeler, M. C., & Lee, D. L. (2002). Using technology to deliver immediate corrective feedback to preservice teachers. *Journal of Behavioral Education, 11*(4), 231-241.

APPENDIX D
LINKS TO VIDEOS OF EXAMPLES AND NON-EXAMPLES OF COMPLETE TTC TRIALS

Recorded Video Examples and Non-examples of TTC Trials

The following are hyperlinks to recorded video examples of correctly completed TTC trials targeted in this study:

1. Correct student response:

http://tinyurl.com/cy86gyj

2. Incorrect student response:

http://tinyurl.com/c87kryk

The following are hyperlinks to recorded video non-examples of correctly completed TTC trials targeted in this study:

1. Correct student response:

http://tinyurl.com/c8p9fz8

2. Incorrect student response:

http://tinyurl.com/cnerzmb

APPENDIX E
PARTICIPANT INVENTORY

Participant Inventory

What is your name? *

Please provide your age:

Gender:

Ethnicity:

Career previous to teaching:

How long have you been teaching?

What subject area(s) do you teach?

How many students with emotional and behavioral disorders (EBD) do you teach?

During what time(s) of the day do you teach your student(s) with EBD?

Number of other students taught during the same time?

Do you have a co-teacher?

Please provide the following information about each of your students with EBD:

- Name*:
- Age:
- Ethnicity:
- I.Q:
- Medical diagnosis:
- Strengths:
- Challenges:

Please describe your classroom:

Please describe your typical routine during which you teach your students with EBD:

*****All information will be coded to protect identity.

APPENDIX F
ADOBE® CONNECT™ VISUAL QUICK START GUIDE

ADOBE® CONNECT™
VISUAL QUICK START GUIDE

Partcipate in Adobe Connect Meetings

Adobe Connect is an enterprise web conferencing solution for online meetings, eLearning and webinars used by leading corporations and government agencies. This Visual Quick Start Guide provides you with the basics participating in an Adobe Connect meeting, virtual classroom, or webinar.

Attend an Adobe Connect meeting

1. It is recommended that you test your computer prior to attending a meeting. You can do this by going to http://admin.adobeconnect.com/common/help/en/support/meeting_test.htm

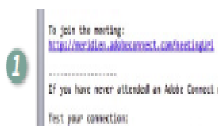
2. The **Connection Test** checks your computer to make sure all system requirements are met. If you pass the first three steps of the test, then you are ready to participate in a meeting.

Tip: The fourth step of the **Connection Test** is for the Adobe Connect Add-in which is only required for Meetings Hosts and Presenters who need to share their screen. Installing the add-in is not required, but may enhance your meeting experience.

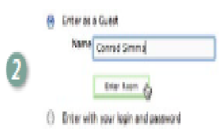
3. If you do not pass the test, perform the suggested actions and run the test again.

Join a meeting

1. You have likely received an email invitation with meeting access information. When the meeting time arrives, click on the link or enter the URL into your favorite web browser.

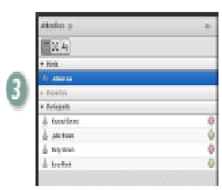


2. The meeting login screen appears. If you do not have a username or password for the Adobe Connect account, choose ***Enter as a Guest***, type in your first and last name, and click ***Enter Room***.



3. The meeting launches in your browser. If the meeting host has not yet arrived to the meeting or meeting security requires the host to approve your attendance, you will be placed in a waiting room.

4. Once the meeting host accepts you into the meeting, the meeting room interface appears.



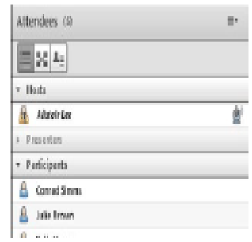
Tip: Adobe Connect only requires that you have an internet connection, a web browser, and Adobe Flash Player version 10.1 or greater to attend a web conference. Adobe Connect supports nearly any operating system including Windows, Macintosh, Linux and Solaris, as well as the most widely used browsers including Internet Explorer, Firefox, Safari, and Chrome.

Meeting audio

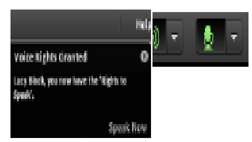
Meeting hosts have control over how the audio portion of your meeting is conducted. They can choose to use Voice-over-IP (VoIP), Integrated Telephony, or Universal Voice (a non-integrated teleconference).

Option 1: Voice-over-IP

When this option is selected, you can hear meeting audio through your computer speakers. If a meeting attendee is speaking using VoIP, you will see a microphone icon next to their name.



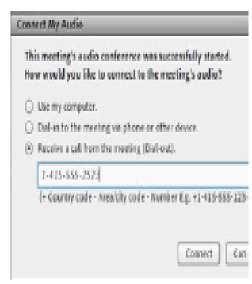
In some cases, meeting hosts may give you the ability to broadcast audio using VoIP. When this is the case, a dialog will alert you that you have the rights to use your microphone. Clicking the ***Speak Now*** link will activate the microphone icon in the **Application Bar** at the top of your screen.



Tip: If you are having issues using VoIP, it is recommended that you run through the Audio Setup Wizard to optimize your experience. To do this, select '***Audio Setup Wizard...***' from the **Meeting** menu.

Option 2: Integrated Telephony

If the meeting host has set up the room to use an integrated teleconference, then Adobe Connect will prompt participants to select how they would like to hear the audio. You can select to listen through your computer speakers if the host has enabled this, you can view the dial-in information, or you can have Adobe Connect dial-out to your telephone by entering your phone number and clicking ***Connect***.



This dialog can also be launched by clicking the telephone icon in the **Application Bar.**

Option 3: Universal Voice

Adobe Connect can also bridge non-integrated audio conferences into a meeting room so that the meeting can be recorded and the audio can be broadcast through the computer speakers of the participants. If the meeting host has selected a non-integrated teleconference (Universal Voice), you can listen to the audio through your computer speakers. If you'd prefer to listen over the phone, you can click the telephone icon in the **Application Bar** to see the dial-in information.

If the meeting host gives you the rights to speak, you can use your computer's microphone or your telephone handset to speak to the other meeting attendees.

ADOBE® CONNECT™
VISUAL QUICK START GUIDE

Share webcam video

The meeting host may ask you to use your webcam to share video. When this is the case, a button enabling you to share your webcam will appear on the video pod. To share your camera, make sure your web cam is plugged in and click the ***Share My Webcam*** button. Adobe Flash may prompt you for permission. After granting permission, a webcam video preview appears. If you're happy with the preview, click ***Start Sharing*** to share your video with all participants.

You can also click the webcam icon in the **Application Bar** to access your webcam and preferences.

Change your status

Within a meeting, you can also change your status to provide feedback to the presenter and other attendees.

To change your status, click the arrow on the ***Status Options*** dropdown list on the **Application Bar** and select your desired status option.

If you select an option above the line such as ***Agree*** or ***Step Away***, you status remains until you choose ***Clear Status***. If you choose an option below the line such as ***Speed Up*** or ***Applause***, your status automatically clears itself after a number of seconds.

When you set your status, an icon appears next to your name in the **Attendees** pod.

Chat

To send a message to everyone, simply type your message in the chat pod and hit enter or click the send icon.

If the meeting host has enabled private chat, you can send messages to a specific attendee or group within the meeting. To do this, use the **Attendees** pod to hover over the name of the attendee you'd like to chat with, and select ***Start Private Chat***. Alternatively, you can use the Pod Options menu in the top right hand corner of the pod to select an individual or group by clicking ***Start Chat With***. Private chat messages show up in additional tabs to make it easy to distinguish between private and public chat.

If the host is using a **Q&A** pod instead of a **Chat** pod, then all messages are moderated and private chat is not available.

Troubleshooting

Issue	Solution
I cannot get into the meeting	If you are having trouble joining a meeting try the following: 1. Enter the meeting as a Guest user by entering in your First and Last Name in the Guest field. 2. Click the Help link on the Meeting Login page. This takes you to the Test Meeting Connection page where you can verify that your computer meets all necessary requirements. If you do not pass the test you will be given instructions for what you need to do. 3. Make sure popup blocking software is not blocking your meeting window. 4. You may be using a proxy server. To resolve this in Internet Explorer, select Tools > Internet Options > Advanced tab. Then enable the setting Use HTTP 1.1 through proxy connections. After doing this, clear your cookies, close all browser windows and attempt to re-enter the meeting.
I cannot hear any audio	1. Verify that your computer speakers are on and your computer's volume is at an audible level. 2. Check to see if the meeting host has provided teleconference information. If this is the case, you need to dial in via telephone to hear meeting audio.
I have been granted rights to speak, but no one can hear me	If you are having trouble sharing your voice try the following tasks: 1. Make sure your computer microphone is not muted. 2. Run through the Audio Setup Wizard. To do this, select ***Meeting > Audio Setup Wizard***. The wizard guides you through five steps in which your computer is tuned for optimal VoIP. 3. You may have elected to deny the Flash Player access to your computer's microphone. To verify this, right click in the meeting window and choose ***Settings*** to view your Flash Player settings. In the dialog box, choose ***Allow***.
The host is sharing their screen, but it is fuzzy	If you are having trouble seeing a hosts screen, try the following: 1. Click the Full Screen button on the top of the Share pod. 2. View the full resolution by using the pod options menu in the top right hand corner of the pod to select ***Change View > Zoom In***.

Learn More

You can find additional resources by visiting the Adobe Connect User Community at www.connectusers.com

https://seminars.adobeconnect.com/_a227210/vqs-participants/

APPENDIX G
SOCIAL VALIDITY PROTOCOL

Social Validity Interview Protocol*

Please answer the following questions. Your answers will be recorded and used to assess the social validity of the treatment you used in the research study. Your responses will be kept confidential. Only Dennis Garland and Dr. Lisa Dieker will have access to your answers on this interview. Please answer as thoroughly as possible. Thank you for your answers!

1. Did you like receiving feedback from the investigators using the bug-in-ear?
    a. Why/why not?
2. How did you feel about wearing the earpiece while teaching?
3. Were you distracted by the feedback?
4. How did you feel about using webcams and Adobe® Connect™ throughout the study.
5. What did you like/dislike about it?
6. Do you have any suggestions for the investigators on ways to improve or change the way we use webcams and bug-in-ear (Bluetooth® earpieces) for future teachers?
7. Would you recommend using the bug-in-ear device and webcams to other teachers or supervisors? (If no, please give a brief explanation for your answer).
8. What other ways could teachers use bug-in-the-ear technology?
9. What impact, if any, did using the bug-in-ear have on your students? (e.g., changes in student behavior, student outcomes, etc.)

Thank you so much for making a difference in the way we prepare future teachers!

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX H
PROTOCOL FOR TRAINING PARTICIPANTS IN USE OF BIE

Protocol for Training Participants in Use of BIE*

1. Training will be done in with each teacher individually.
2. Each teacher will practice attaching and wearing the BIE listening device.
3. Each teacher will be given a hyperlink to the virtual classroom.
4. The teacher will meet the investigator in the virtual classroom by accessing the hyperlink on the Internet while in their classroom. The investigator will access the virtual classroom while online in an adjacent room. Upon entering the virtual classroom, the teacher is automatically assigned to the role of "participant". The investigator, who has the role of "host", will promote each teacher to the role of "host" so s/he can activate audio and camera from her/his digital device.
5. Once the teacher has enabled her/his web camera and microphone (default is the earpiece), the investigator will communicate with the teacher while the participant walks to each of the corners of her/his classroom.
6. Each teacher will be given the option to practice using BIE in a second training session. During the second 15-minute training session, the teacher will wear the BIE device while teaching her/his students in the natural environment and will receive the same type of feedback as in the simulated lesson.
7. The teacher will be instructed to respond to students who ask about the BIE device by saying it is something she/he is using to help her/him become a better teacher.
8. The teacher may request additional training time. All questions regarding the use of the BIE will be answered prior to the start of the intervention.

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education*, *35*(1), 77-90.

APPENDIX I
PROTOCOL FOR DELIVERING IMMEDIATE FEEDBACK

Protocol for Delivering Immediate Feedback*

1. The investigator will provide immediate corrective feedback on teacher's delivery of three-term contingency trials via BIE device, no more than three seconds after behavior is observed. The following format will be used to deliver immediate feedback:

   A. Verbal corrective feedback from the investigator to the teacher when the teacher does not deliver a consequence to a pupil's incorrect response will be: a) "This is a rule or concept error. Use a procedural correction", or b) "This is a fact error. Use a fact correction" (for error), and c) "Reinforce correct response" (for correct response). Finally, "When the pupil does not respond, repeat the question."

      - Example: a) While preparing for laboratory experiment, the pupil handles materials without first putting on safety equipment. Teacher does not acknowledge. Investigator says, "This is a rule error. Use a rule correction."

      - Example: b) Pupil makes a factual error, stating the troposphere is above the mesosphere.

        Teacher does not acknowledge.

        Investigator says, "This is a fact error. Use a fact correction."

      - Example: c) Pupil gives a correct response, saying frogs are amphibians.

        Teacher does not acknowledge.

        Investigator says, "Reinforce correct response."

B. The investigator will reinforce the teacher with verbal praise for completing three-term contingency trials.

    - Example: "Excellent work," and after the final trial, "You completed (number) trials in this lesson."

2. The teacher does not receive any written feedback from the investigator, nor does he/she participate in a post-observation conference with the investigator.

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX J
PROTOCOL FOR BASELINE

Protocol for Baseline*

Preparation to Begin Study:

- ✓ Provide needed technology and train participants on the use of BIE and Adobe® Connect™
- ✓ Collect Participant Inventories

<u>Steps in Baseline:</u>

1. Tell each teacher to, "Do what you normally do for instruction during this baseline and wear the earpiece in the on position."
2. Investigator and teacher will meet in Adobe® Connect™ room at scheduled time.
3. Investigator will observe each teacher for four to six sessions per week, 20 minutes maximum, each session.
4. Investigator will code and record data on selected dependent variables.
5. Computation of reliability and fidelity of treatment data will occur on 30% of the sessions.
6. The first teacher will begin intervention after stable baseline is reached in a minimum of 3 baseline sessions. The second teacher will begin intervention after stable baseline and at least 3 data points after first teacher has entered intervention. The third teacher will begin intervention after stable baseline and at least 3 data points beyond second teacher receiving treatment. If needed, names will be randomly drawn to determine which teacher will enter conditions.

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX K
PROTOCOL FOR INTERVENTION

Protocol for Intervention*

1. Set up technology for each observation.
2. Instruct the teacher to wear BIE listening device in the on position during lesson.
3. Observe each teacher for two sessions per week, 15 minutes minimum and 20 minutes maximum, each session.
4. Investigator provides immediate feedback on the target behavior (completion of learning trials) one to three seconds after the behavior is observed. Feedback is provided using a "code word" or phrase selected by the teacher to prompt performance of the selected behavior. For example, "praise" could be used to prompt providing praise and "correct error" might be used for error corrections on student responses in order to complete learning trials. "Be specific" could be used to prompt use of specific praise.
5. The teacher does not receive any written or delayed feedback from the investigator on the dependent variable during intervention.
6. The investigator and secondary observer record and code data on the dependent variable on 30% of the sessions.
7. Investigators compute reliability and fidelity of treatment data on 30% of the sessions.
8. When teacher has reached 90% on three consecutive data points, fade feedback to that teacher.
9. Collect maintenance data 2 weeks after intervention through probes. During this time, fade the use of BIE by having the teacher:
    - turn the listening device to the off position, but continue to wear it, then
    - physically remove the receiver, but still keep it in view, and
    - finally, remove the BIE from view.

10. Conduct interviews for social validity at the conclusion of the study.

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX L
SOCIAL VALIDITY PROTOCOL RESULTS

Social Validity Protocol*

Please answer the following questions. Your answers will be recorded and used to assess the social validity of the treatment you used in the research study. Your responses will be kept confidential. Only Dennis Garland and Dr. Lisa Dieker will have access to your answers on this interview. Please answer as thoroughly as possible. Thank you for your answers!

Did you like receiving feedback from the researchers using the bug-in-ear?

a. Why/why not?

Eliza:

“Yes, I liked receiving feedback from the researcher using the bud-in-ear because the feedback was quick and related to what was occurring in my class at that moment. The feedback was between the researcher and myself. “

Katherine:

“Yes, it helped reinforce ideas that I may have forgotten in the moment. When the study was over, I actually missed having the feedback that I came to rely on.”

Tom:

“It was helpful to be reminded to praise and reinforce their behaviors. Sometimes getting through the lesson can take so much time that you forget to think about teaching methods. It was very relevant and helpful during times that could have gotten out of hand if I didn’t follow through with my students.”

How did you feel about wearing the earpiece while teaching?

Eliza:

“At first I was unsure about things (would it distract the students? Would it distract me from teaching, did I put it on correctly…etc.), but the more I used it I really liked it and it became a normal routine.”

Katherine:

“It was slightly distracting at first, but I got used to it.”

Tom:

“It was slightly distracting.”

Were you distracted by the feedback?

Eliza:

“No, there were times I would get feedback that I didn’t understand or didn’t fit to what was going on. Example: Praise the student for sitting down. The student wasn’t sitting down yet. So I didn’t respond when I received the feedback, I responded when the student did sit down.”

Katherine:

“Very little, but a few times.”

Tom:

“No, but there were times when I couldn’t hear because my students were too loud.”

How did you feel about using webcams and Adobe® Connect™ throughout the study?

Eliza:

“Before this study I have not used Adobe® Connect™, but not that I have experience with it; the program was easy to use and easy to set up between classes in preparation for the observation/feedback.”

Katherine:

"The students catch on quickly and have a lot of questions – so it makes things difficult I had to remind them that I was learning how to be a better teacher."

Tom:

"I had to log into the app between classes while my kids were coming in, so it was hard to get them to settle down once I was set up. The students were always curious, and it was distracting when we would lose a signal, but it was easy to get back on because the app was already open on my phone, so I just logged back in. It was a good way to get feedback on my teaching."

What did you like/dislike about it?

Eliza:

"I liked how easy the program was to use (user friendly). I don't know if it was the program or my Ipad, but we would get disconnected and I would have to stop and try to reconnect. I think using the Ipad was easier than the webcam, because the program and the webcam where right there instead of setting up 3 (program, webcam, Bluetooth) things, only had to set up 2 (Program and Bluetooth)."

Katherine:

"See above."

Tom:

"It was a more private way to have an observation."

Do you have any suggestions for the researchers on ways to improve or change the way we use webcams and bug-in-ear (Bluetooth or headpieces) for future teachers?

Eliza:

"Maybe use an Ipad instead of the webcam. Otherwise I think everything was great! By using the Ipad instead of the webcam I was able to use the Fusion Interactive lesson. If I would have used the webcam I would not have been able to use the Interactive lesson due to the feedback going over my classroom speakers instead of the Bluetooth."

Katherine:

"Ensure that things are more discreet so students can't see the camera."

Tom:

"Provide some kind of stand for ease of setup. I had limited time to get ready when we met."

Would you recommend using the bug-in-ear device and webcams to other teachers or supervisors? (If no, please give a brief explanation for your answer).

Eliza:

"Yes, my class was not disrupted from someone coming in or leaving. It was discrete. It was less threatening then administrative observations. I could be myself."

Katherine:

"Yes."

Tom:

"Yes."

What other ways could teachers use Bug-in-the-Ear technology?

Eliza:

“Classroom management, new teachers during their methods placements or student teaching, and administration giving feedback are a few ways Teachers could use this technology. If there is a new strategy, this could be a way to help teachers get the feedback they need to succeed, without a person coming in and disrupting class.”

Katherine:

“Co-teaching.”

Tom:

“It would be a great tool to provide mentoring from other teachers at my school so we could follow up with each other during PLC meetings.”

What impact, if any, did using the bug-in-ear have on your students? (e.g., changes in student behavior, student outcomes, etc.).

Eliza:

“I did notice that when I was teaching, the students would tell me if I was disconnected (Ipad screen would turn black). But I did notice that on days I didn’t wear it the students would ask why I wasn’t wearing it, which was interesting since I didn’t tell the students what was going on with the webcam and Bluetooth.

I have seen a HUGE improvement in behavior from my students. Students that wouldn’t do any work have started producing (some) work particularly in the case of (Steve). I’ve learned a lot from this experience and would definitely do it again! ☺”

Katherine:

“My students responded better when I was given cues. I was amazed at some of the results. It just goes to show how far praise and follow through can go.”

Tom:

“I did find that they responded better when they got praised for following directions and when I was more positive with them. It was like they were just waiting for someone to acknowledge their good work. I will definitely continue to use this strategy in the future.”

Thank you so much for making a difference in the way we prepare future teachers!

***Adapted from:**

Scheeler, M. C., McKinnon, K., & Stout, J. (2012). Effects of immediate feedback delivered via webcam and bug-in-the ear technology on preservice teacher performance. *Teacher Education and Special Education, 35*(1), 77-90.

APPENDIX M
INSTITUTIONAL REVIEW BOARD LETTER OF APPROVAL

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Dennis Garland**

Date: **February 21, 2013**

Dear Researcher:

On 2/21/2013, the IRB approved the following human participant research until 02/20/2014 inclusive:

Type of Review:	UCF Initial Review Submission Form
Project Title:	Virtual Coaching of Novice Science Teachers to Improve Outcomes of Students with Emotional and Behavioral Disorders.
Investigator:	Dennis Garland
IRB Number:	SBE-13-09088
Funding Agency:	
Grant Title:	
Research ID:	N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

If continuing review approval is not granted before the expiration date of 02/20/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

[%electronic_signature%]
IRB Coordinator

Page 1 of 1

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